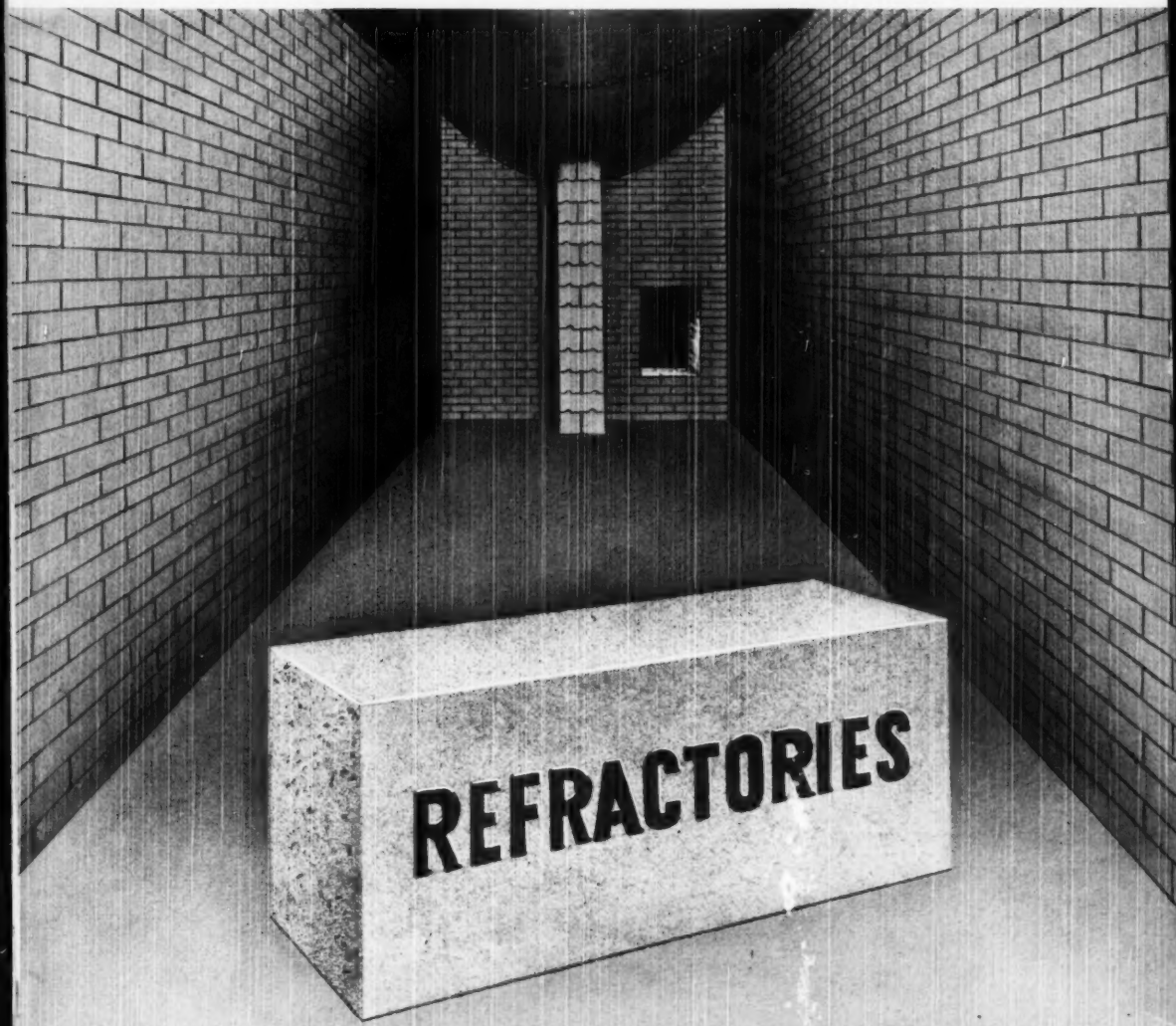
POWER

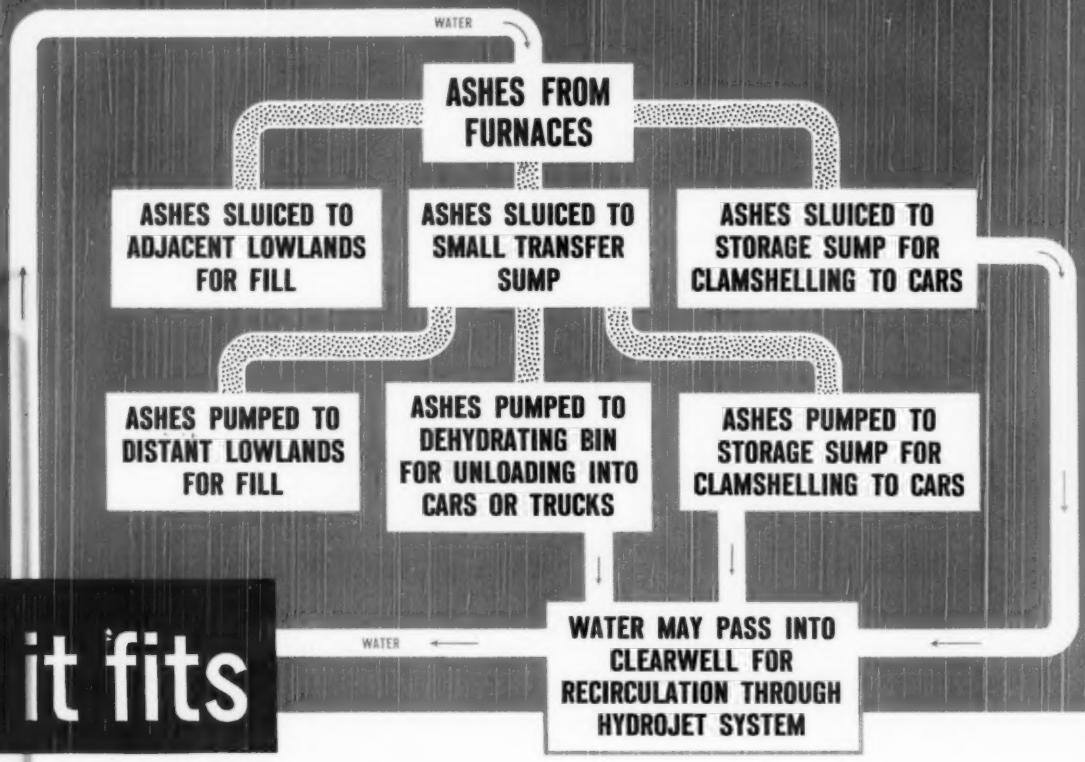
A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

JUNE 1950



A 16-p PRACTICAL HANDBOOK, p73 • CONTENTS, p69

VERSATILE


WATER
ASHES FROM FURNACES
ASHES SLUICED TO ADJACENT LOWLANDS FOR FILL
ASHES SLUICED TO SMALL TRANSFER SUMP
ASHES SLUICED TO STORAGE SUMP FOR CLAMSHELLING TO CARS
ASHES PUMPED TO DISTANT LOWLANDS FOR FILL
ASHES PUMPED TO DEHYDRATING BIN FOR UNLOADING INTO CARS OR TRUCKS
ASHES PUMPED TO STORAGE SUMP FOR CLAMSHELLING TO CARS
WATER
WATER MAY PASS INTO CLEARWELL FOR RECIRCULATION THROUGH HYDROJET SYSTEM

it fits

your ASH problem

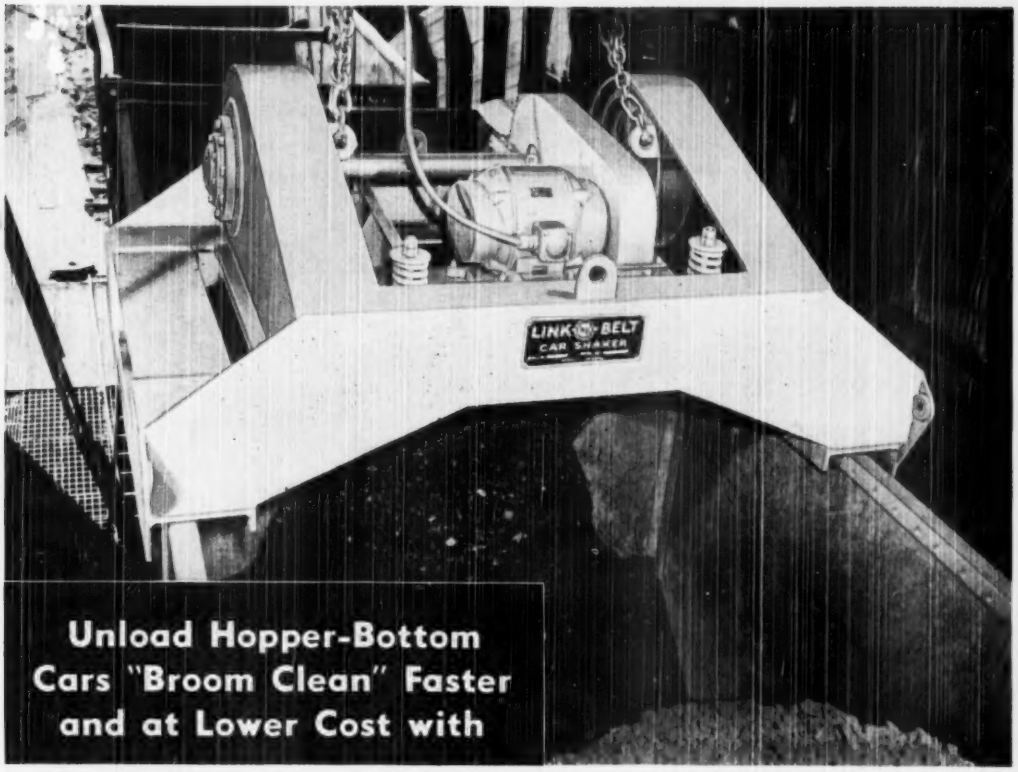
Hydrojet Systems can be made to fit any type of coal-fired furnace under almost any conditions of service, and will dispose of the ashes in any of the ways shown. Where water is at a premium or stream pollution must be avoided, recirculation of the water used for ash removal is provided for. Ashes may be accumulated for a considerable period of time, and then be removed at the rate of ½ to 1 ton per minute. Hydrojetting assures minimum labor, power, and maintenance, as well as full boiler capacity and efficiency. Since the system is totally enclosed from the furnace to the point of disposal, hazards such as heat, flying dust, and noxious gas are completely eliminated.

This modern, economical method of ash removal can be readily adapted to your present needs. Our nearest representative will be glad to give you the details. Write us.

HYDROJET ash handling system

ALLEN-SHERMAN-HOFF CO., 227 S. 15th ST., PHILADELPHIA 2, PA. *Offices & Representatives in Principal Cities*

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," "The Stationary Engineer"), June, 1950, Vol. 94, No. 6. Published monthly with an additional Directory number in June. McGraw-Hill Publishing Company, Inc. Editorial and executive offices, 330 W. 42nd St., New York 18, N. Y. Entered as second class matter January 26, 1949, at the post office at New York, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least 10 days for change of address. Subscription rates, U. S. and U. S. possessions, $5 for one year, $7 for two years, 65c per single copy. Canada $7 for one year, $11 for two years. Pan American Countries, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years. Please indicate position and company connection on all subscription orders.



Unload Hopper-Bottom Cars "Broom Clean" Faster and at Lower Cost with

LINK-BELT CAR SHAKER

THE ONLY CAR SHAKER WITH *ALL* THESE IMPORTANT FEATURES

POSITIVE ACTION—Lower vibrator speed results in positive impact action. Easier on cars. Vibration rate adjustable in the field for all types of coal and other bulk materials.

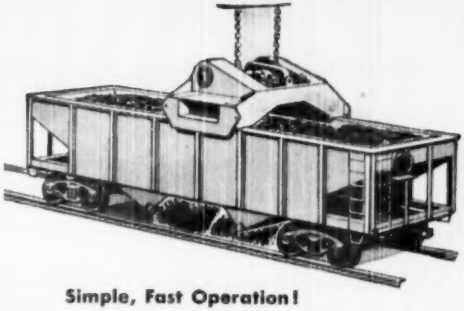
ELIMINATES OBJECTIONABLE NOISE—Low-frequency results in a relatively low sound level.

LOWER COSTS—Only 1 to 3 minutes required for "broom-clean" unloading of most cars. Especially effective for unloading damp or sticky materials.

LONGER LASTING, SAFE—Lower operating speed reduces wear and maintenance. Rugged construction. No picks or hammers needed. Less hazard to crew.

UNDIVIDED RESPONSIBILITY—Link-Belt can furnish, when required, the complete system, including shaker, hoist, frame, track hoppers, feeders and conveyors.

Check your present unloading methods against the dollar-saving efficiency assured by Link-Belt's exclusive features. Get full details on installation and application to your needs. Send for Book No. 2345.



Simple, Fast Operation!

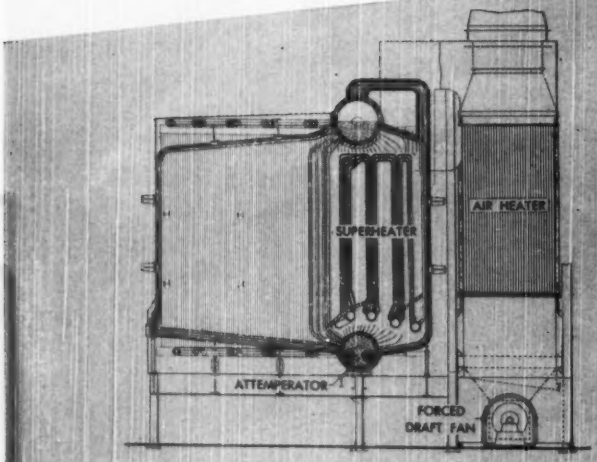
★ Lower the Link-Belt Car Shaker to the top of car walls.

★ Start motor. Positive-action vibration on car sides and hopper bottoms does the job clean and fast.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Johannesburg. Offices in Principal Cities.

11,166



B&W Integral-Furnace Boiler, Type FH, with pressurized casing, now in successful operation in outdoor central station installation. Design capacity is 300,000 lb. of steam per hr. at 875 psi and 910 F with gas-firing.

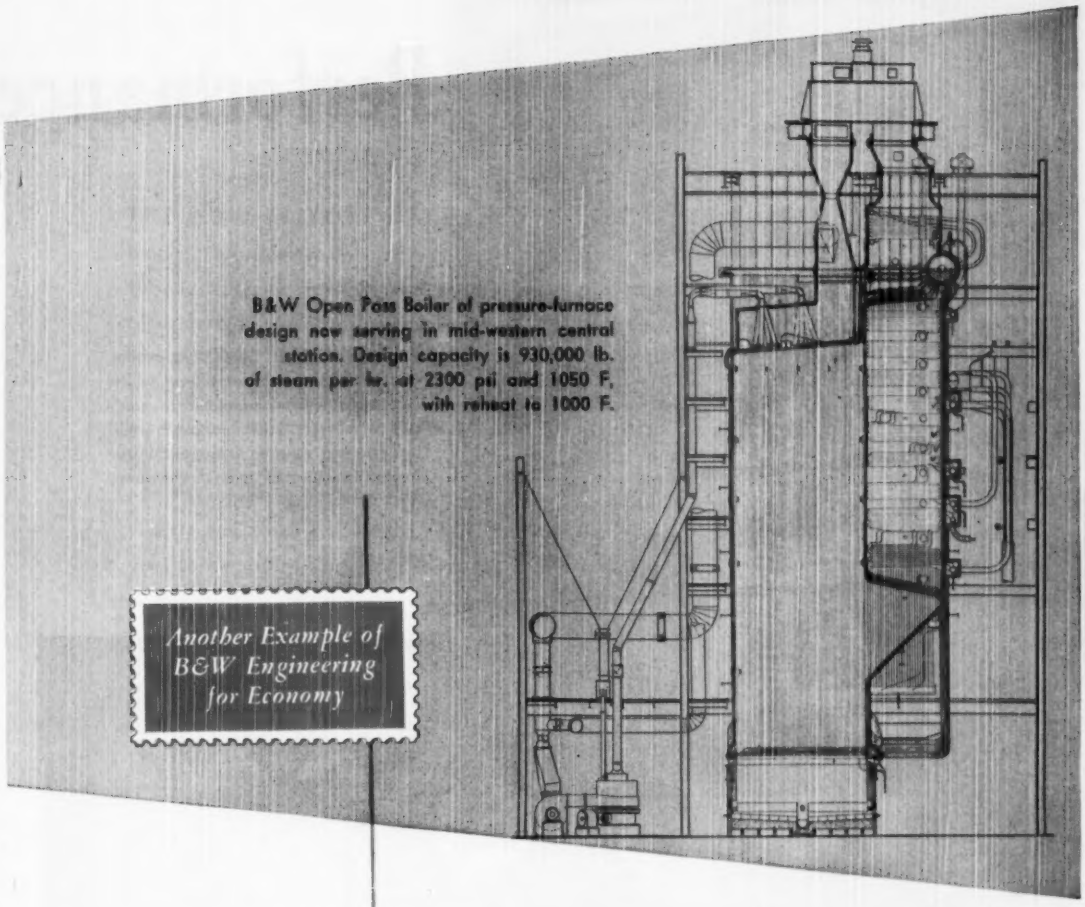
PRESSURIZED

FOR NEW ECONOMIES

Demand charge for Induced-Draft fan capacity may run as high as one-half of one per cent of gross generating capacity . . . an appreciable expense to any central station. Maintenance, too, is excessive because of constant exposure to hot gases and entrained abrasive particles.

These reasons help explain the importance of B&W's latest development —pressurized furnace construction. ID fans can be eliminated and users assured of the four big advantages listed on the opposite page.

A creative approach to boiler design and application, working in close co-operation with far-sighted managements and power engineers, has identified B&W with steam-power progress for more than 80 years. Perhaps it's just what is needed to effect significant steam-generating economies in the solution of *your* present problems or future plans.



B&W Open Pass Boiler of pressure-furnace design now serving in mid-western central station. Design capacity is 930,000 lb. of steam per hr. at 2300 psi and 1050 F, with reheat to 1000 F.

Another Example of B&W Engineering for Economy

...improved principle of boiler-furnace operation pioneered by B&W

...OFFERS MAJOR COST SAVING ADVANTAGES

1. Eliminates ID fan — lowers demand charge.
2. Prevents air infiltration — provides higher boiler efficiency.
3. Simplifies draft control — permits quick, easy, effective adjustment to optimum combustion conditions at all loads.
4. Simplifies design — lowers initial cost of duct and stack arrangement.

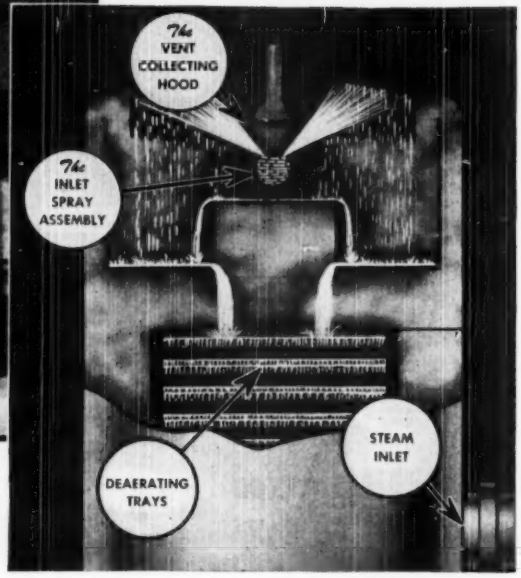
Helping Industry Cut Steam Costs Since 1867

BABCOCK & WILCOX

G-4857

Performance

At left, the Elliott 120,000 lb.-per-hr. deaerating heater of latest type, which is setting a new low-maintenance standard in a large California plant while delivering oxygen-free feedwater heated to saturated steam temperature.



Illustrating the operation of the Elliott tray-type deaerating heater. Water entering through the inlet spray assembly is sprayed across the opening of the vent collecting hood into the heating compartment, falls to the bottom of the heating section and down to the trays. By this time it has become heated to close to steam temperature. Falling from tray to tray it is constantly agitated and releases its noncondensable gases, which are carried upward by the incoming steam and ultimately through the vent collecting hood out the vent opening.

ELLIOTT

TRAY-TYPE

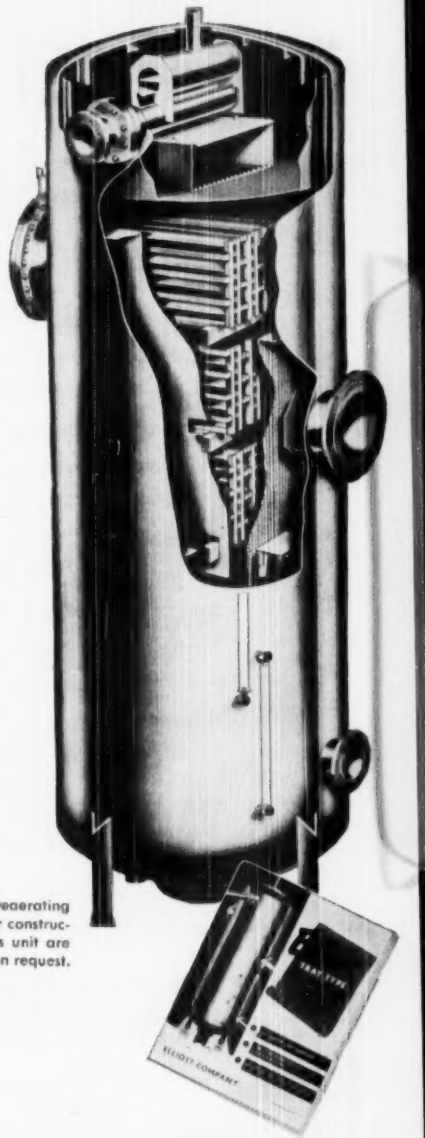
speaks louder than claims

THE NEW ELLIOTT DEAERATING HEATER made its appearance approximately two years ago, offering almost entire freedom from maintenance required by older design heaters. This offer has now been completely substantiated by the performance of units such as that pictured on the opposite page. This is a 120,000-lb.-per-hr. heater serving a large nationally known western industrial plant. The heater has required no maintenance nor given one moment's trouble since its final adjustment and start-up some ten months ago, inspiring the enthusiastic comments of the boiler room staff.

This is the heater that needs no tubular vent condenser, the function of that potentially troublesome element being handled inside the heater shell by a permanently located vent collecting hood, and a simple inlet spray assembly, which may be withdrawn for inspection if desired.

Stainless steel is used throughout, wherever corrosive gases are encountered. This includes trays which are far lighter than the cast trays of earlier design.

Elliott engineers pioneered the deaerating heater, and with this new design are keeping in the forefront of progress.



The Elliott Tray Type Deaerating Heater, showing interior construction. Full details on this unit are given in Bulletin N-16, on request.

ELLIOTT COMPANY, Deaerator and Heater Dept.
JEANNETTE, PA.

Plants at: JEANNETTE, PA. • RIDGWAY, PA.
AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

N-995

DEAERATING FEEDWATER HEATERS
—require no tubular vent condensers

Minimum

Boiler Cleaning Cost results from

Diamond has continuously carried on basic research to improve boiler cleaning. This has covered nozzle design, flow patterns through tube nests, and pressure drop in cleaning equipment. This research, plus 80% of the soot blower experience, gives the vast engineering background necessary in meeting today's difficult boiler cleaning problems.

This unequalled experience pays off to the purchaser of Diamond Soot Blowers in better boiler cleaning at lower cost . . . for there is no substitute for experience in the soot blower industry. Experience can be gained only by making installations . . . seeing to it that they operate satisfactorily . . . servicing them periodically . . . over the years.

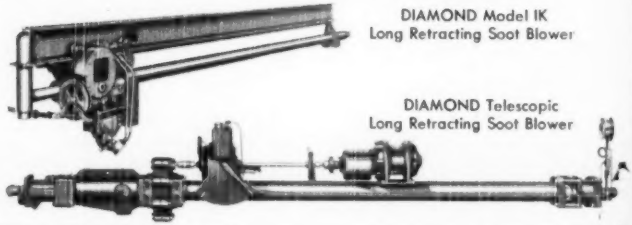
As a result, when you buy Diamond Soot Blowers you are assured of the most advanced design, the finest materials, the best workmanship and correct application. All this adds up to minimum boiler cleaning costs when you use Diamond Soot Blowers.

DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Diamond Specialty Limited • Windsor, Ontario

There is a DIAMOND Soot Blower

DIAMOND Model G9B
Soot Blower

DIAMOND Model IS
Short Retracting Soot Blower



DIAMOND Model IK
Long Retracting Soot Blower

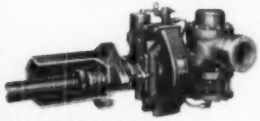
DIAMOND Telescopic
Long Retracting Soot Blower

DIAMOND RESEARCH + EXPERIENCE

80% OF THE SOOT BLOWER BUSINESS RESULTS IN 80% OF THE SOOT BLOWER EXPERIENCE

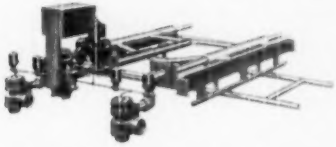
4246

for Every Boiler Cleaning Requirement



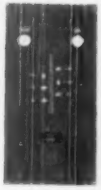
DIAMOND Model A2E Automatic Air Puff Soot Blower

DIAMOND Air Puff Master Controller



DIAMOND Automatic Air Heater Blower

DIAMOND Air Control Panel



...a KVS *Responsibility*

All equipment, electrical as well as mechanical . . . from bunker to bus bar . . . installed ready to be turned over to the owner in operation after all guarantees have been met is what is meant by KVS in offering this service.

Furthermore, KVS will erect steam power plants in any part of the world to operate on low priced fuels so as to assure a very low cost per KW.

POWER PLANT...

Any Size

Anywhere

Any Fuel

Every such plant designed, built and installed by KVS carries a KVS performance guarantee whether or not the equipment is actually built in KVS shops. This means that in KVS there is a single responsibility for the overall performance of the complete power plant.

You are invited to investigate KVS experience, facilities and ability to meet all obligations which are implied in standing back of such performance guarantees and which must be met in rendering a complete, comprehensive service.

Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

KENNEDY-VAN SAUN · QUALITY · SERVICE · Kennedy Products · NEW YORK USA · MFG. & ENG. CORP.

Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

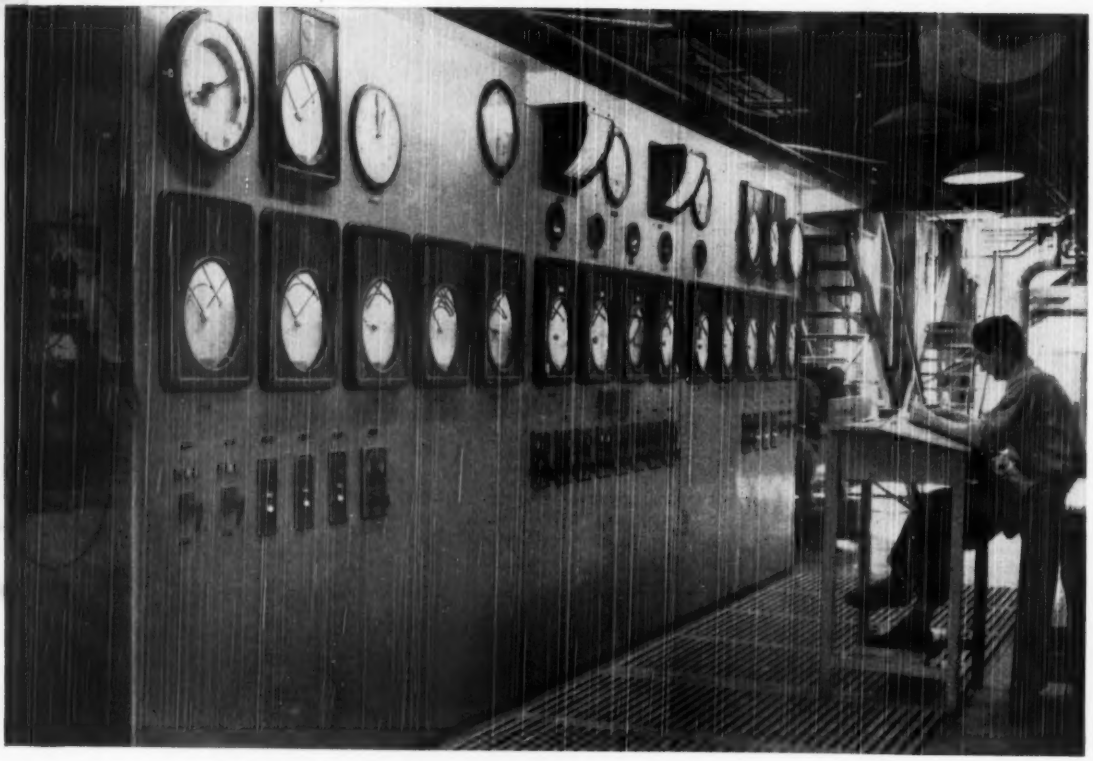
2 PARK AVENUE • NEW YORK 16, N. Y.

FACTORIES: DANVILLE, PA.

CANADA • ENGLAND • FRANCE • AUSTRALIA

ARMY E NAVY

What's YOUR Fuel-dollar



This Bailey Boiler Control Panel insures high efficiency in the use of Fuel-Dollars at a Western Chemical Plant. It includes Bailey Combustion Control, Bailey Three-Element Feed Water Control and Bailey Steam Pressure Reducing Control for two oil-fired boilers.

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

Efficiency ?

A dollar's worth of fuel has the *same potential* energy, no matter who's boiler it fires. But how much of the energy actually gets converted to a usable form depends on how you operate your boiler.

That's where Bailey Controls can help. And, here's why, we believe, you'll get better fuel-dollar efficiency with Bailey:

1. **Complete Range of Equipment—fully co-ordinated.** You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. **Engineering Service—backed by experience.** No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. **Direct Sales-Service—conveniently located near you.** Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

For better fuel-dollar efficiency—for more power per fuel-dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. Were proud to stand on our record: "More power to you!"

A-109

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO

BAILEY METER COMPANY, LIMITED • MONTREAL, CANADA

BAILEY METERS

operating only a few months, at

THE J. WELLER COMPANY

"ARMSBY'S CODE"

WELLER'S
PICKLES, CATSUP, CHILI SAUCE, PUMPKIN AND SAUER KRAUT

OAK HARBOR, OHIO

O. L. TEAGARDEN, PRESIDENT

January 15, 1948

Mr. L. C. Dubs
General Manager
Canton Stoker Corp.
Canton, Ohio

Dear Mr. Dubs:

We believe you are entitled to know something about the operation of the four Canton Stokers which you installed in our plant in February, 1946, as they have performed satisfactorily and have given us greater efficiency than the hand fired boilers. While it is true that we operate only a few months out of each year, the higher efficiency has resulted in greater production of the items we produce.

The fuel and labor saving in connection with the operation of the Stokers as compared to hand firing has resulted in payment of one Stoker each year. The labor saved alone is considerable because one less man is needed with the Stokers than when the boilers were hand fired. The saving in coal is also a large item and while we have not actually weighed the coal used, we do know that from our purchases during the past two years, we have used at least 25% less coal due to the higher efficiency.

The hopper arrangement which was installed is very efficient as the coal is conveyed from this hopper directly to the Stoker through chutes. The upper hopper holds about 20 tons of coal and no additional labor is required to feed the coal to the Stoker as it performs automatically.

During the two years we have used Canton Stokers, they have operated practically trouble free, and the cost of the minor replacements needed has been very low.

We also find that during the balance of the year when we are not canning, there is a secondary saving in the firing of one boiler for heating and processing with the Canton Stoker because of the more uniform steam pressure and also because of the automatic banking switch which keeps the fire active during the off periods.

To sum this up, we would say that the Canton Stokers have given us perfect results and we are very much pleased with them.

Yours very truly,

THE J. WELLER CO.

O. L. Teagarden

OLT:obs

USE
COAL
SAFE
RELIABLE
LOWEST COST

the canning season,

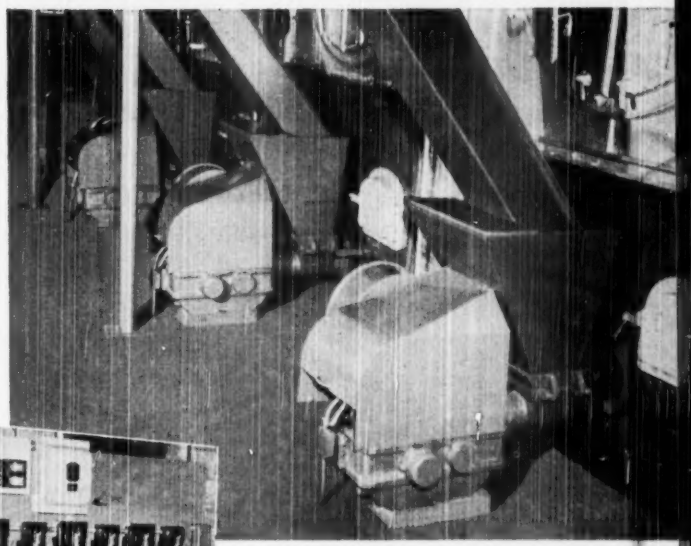
CANTON STOKERS *pay for themselves*

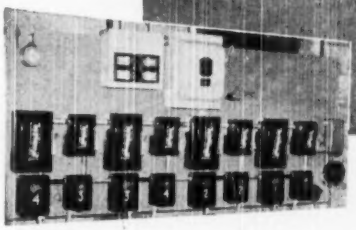
IN ONE YEAR

by fuel and labor savings alone

greater efficiency equals more production in any business

hard to beat a record like this!





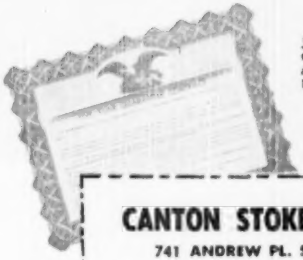
CLOSE-UP OF CANTON AUTOMATIC CONTROLS that keep steam pressure on the dot, increase efficiency of any stoker installation.

Four rugged Canton Lo-Set Ramfeeds along with Canton's cooperative engineering and proper installation produce this outstanding money saving performance for J. WELLER CO. Gravity flow hopper arrangement helps make the investment self-liquidating.

FULL RESPONSIBILITY IS OURS

Here's how we work:

Canton makes some 54 types and sizes for any need. After thorough analysis of YOUR needs by Canton engineers, you select the model that will certainly meet all requirements. Informative bulletins are ready on all Canton Stoker Models. Our staff of field engineers is available for free consultation on combustion problems. Send the coupon or write, wire or phone us today.



J. WELLER COMPANY received this 5 year guarantee . . . insurance against not only DEFECTS but even WEAR itself.

CANTON STOKERS

CANTON STOKER CORPORATION

741 ANDREW PLACE S. W., CANTON, OHIO

CANTON STOKER CORPORATION

741 ANDREW PL. S. W., CANTON, OHIO

☐ Please send all descriptive literature at once

☐ Have a CANTON Engineer interview us immediately

NAME _____

COMPANY _____

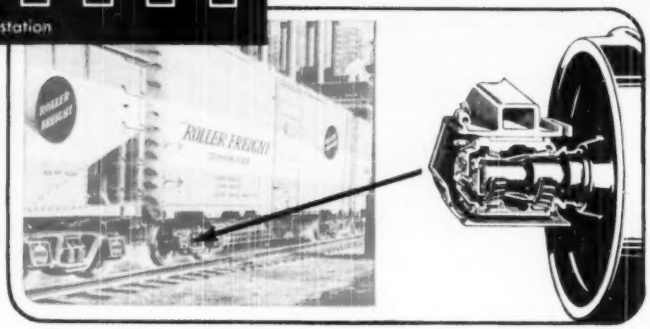
ADDRESS _____

CITY _____ STATE _____

Specified FOR TIMKEN'S Allis-Chalmers

15 kv Vertical lift metal-clad switchgear with DZ-100B oil circuit breakers, part of unit sub No. 5, at Timken's plant number 4-1, Columbus, Ohio.

Circuit diagram shows Timken's Columbus plant arrangement.



Tapered Roller Bearings give faster, smoother rides. Timken's production equipment operates on power distributed by Allis-Chalmers high voltage metal-clad switchgear.

COLUMBUS PLANT...

Switchgear

250,000 kva, 13.2 kv Metal-clad Switchgear Insures Continuous Power and Correct Voltage with Continuity of Service, Plus a High Degree of Reliability.

SPEEDING THE NATION'S FREIGHT, helping to bring your daily needs to you faster and in better condition by reducing starting resistance and operational wear . . . that is one of the big jobs that Timken Roller Bearings are doing.

Providing the power for driving machining equipment necessary for the production of these bearings and other products are 165, 260, 300, and 500 hp synchronous motors.

Protecting these motors and other electrical equipment are seven units of 250,000 kva indoor metal-clad switchgear with DZ-100B oil circuit breakers. These serve six 480 volt load center substations with dry type transformers and low voltage air circuit breakers — *all* standard Allis-Chalmers equipment.

Standard Allis-Chalmers Switchgear

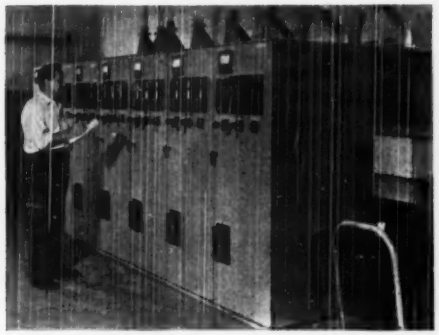
For *any* industrial plant, Allis-Chalmers *standard* switchgear is prefabricated, pretested and completely assembled — ready to operate when delivered.

Choose High or Low Voltage Switchgear

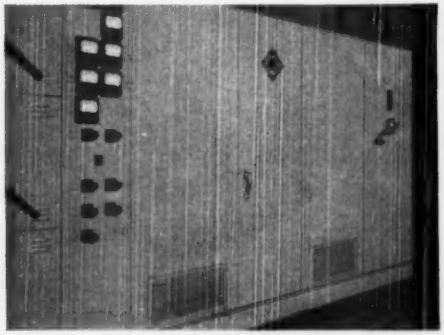
Allis-Chalmers high voltage switchgear can be furnished with Airblast, Oil or *Ruptair* circuit breakers designed for fast interruption of faults and fast reclosing. For secondary installations A-C provides low voltage switchgear employing air circuit breakers that give reliable operation.

For more information on either of these modern switchgear lines, call your nearby Allis-Chalmers district office or write direct. A-2912

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.



Positive circuit protection for production of precision bearings is provided by Allis-Chalmers 15 kv Vertical-lift switchgear with DZ-100B oil circuit breakers.



Unit-Substation with incoming line disconnect switch, 1000 kva dry type transformer, convenient instrument panel feeding 600 volt air circuit breakers.

Ruptair is an Allis-Chalmers trademark.

ALLIS-CHALMERS

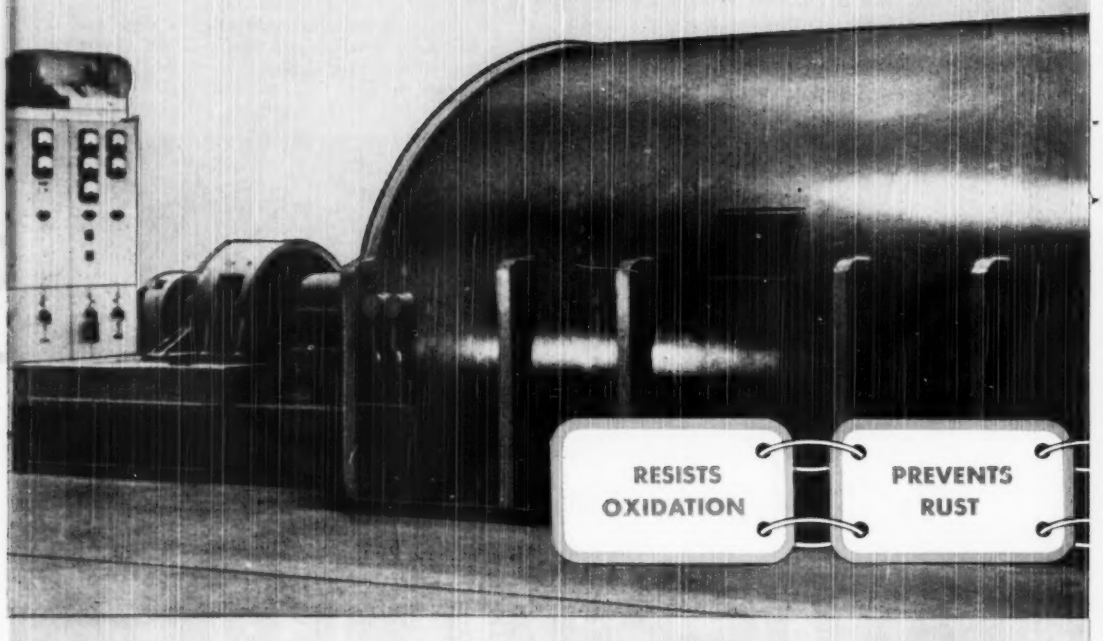
First in the U. S. with Metal-Clad Switchgear

A turbine oil

SINCLAIR

Cats seem to live a charmed life. And in many ways so do Sinclair SINTURLITE Oils! You'd expect the grueling conditions of turbine service to cut short the life of any oil. But SINTURLITE is different!

Not just for months—but for years—SINTURLITE keeps right on lubricating efficiently . . . resisting oxidation, retarding sludge formation, preventing rust, separating readily from water. Long serv-



For lubrication counsel, see your nearest Supplier of Sinclair Products or write to Sinclair Refining Company, 630 Fifth Avenue, New York 20, N. Y.

SINCLAIR

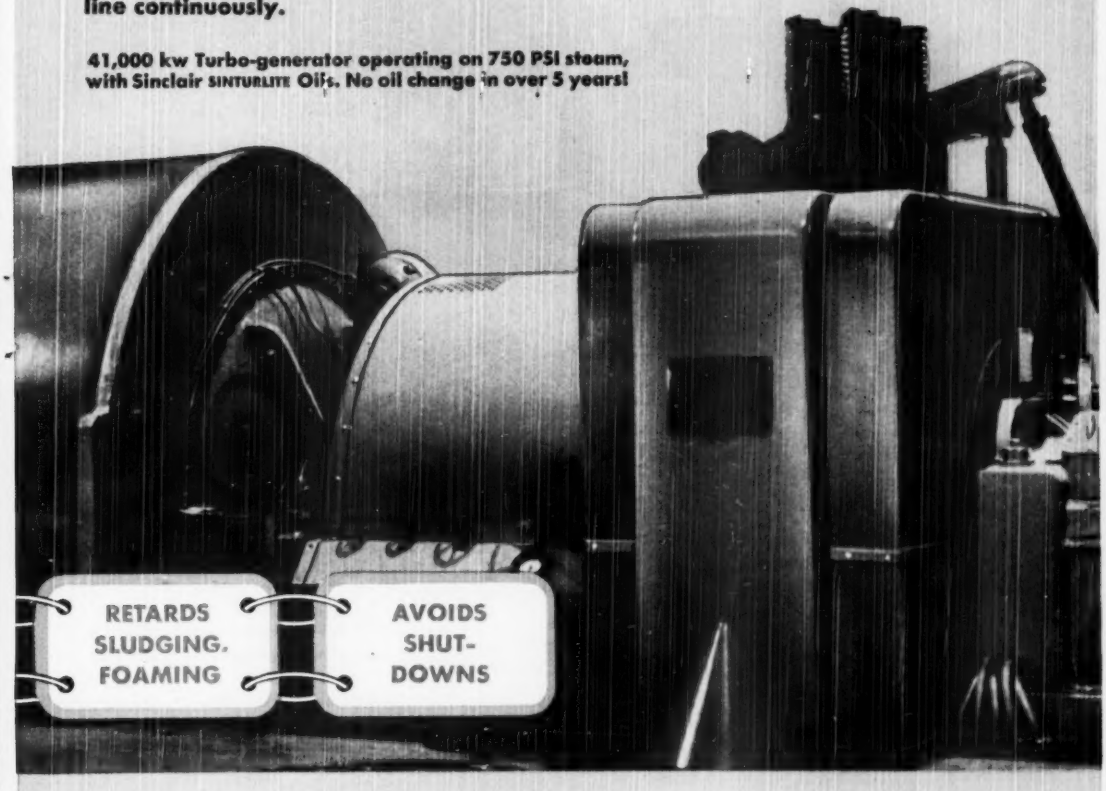
with nine lives...

SINTURLITE

ice life is assured by the superbly refined petroleum base and proven additives that are combined in SINTURLITE.

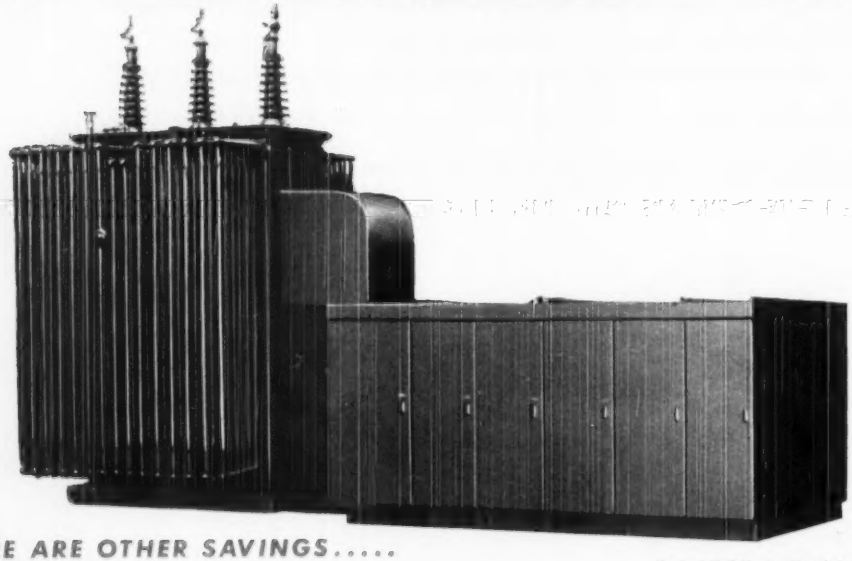
Avoid shutdowns—let SINTURLITE Oils keep your turbines on the line continuously.

41,000 kw Turbo-generator operating on 750 PSI steam, with Sinclair SINTURLITE Oils. No oil change in over 5 years!



INDUSTRIAL OILS

UNIT SUBSTATION *over* FIELD-ASSEMBLED TYPE



Typical G-E Master Unit Substation

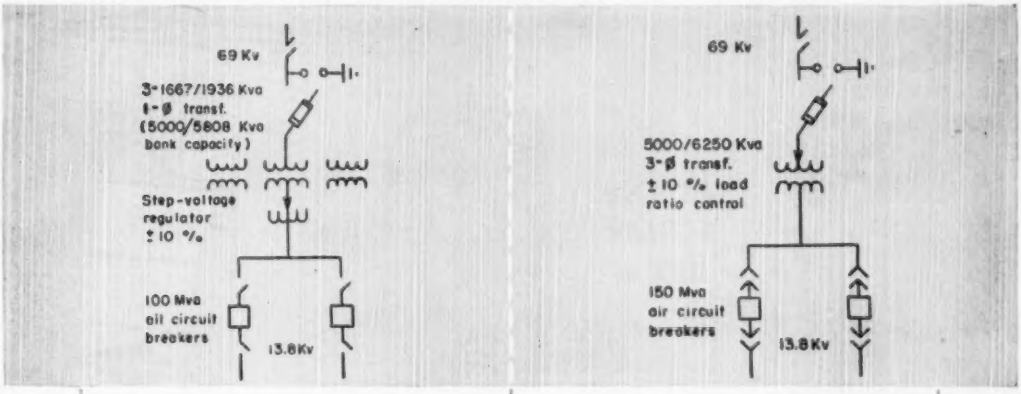
HERE ARE OTHER SAVINGS.....

When you order General Electric Unit Substations your engineering involves only a simple one-line diagram like the one at the right. We do all the detailed specs, prepare construction drawings, electrical diagrams, operating instructions and other paper work to give complete co-ordination of the project—all this on one purchase order, and at lower costs than field-assembled types.

For further information ask your G-E Sales Representative for the publications listed or write to ***Apparatus Department, General Electric Company, Schenectady 5, New York.***

Master Unit Substations	GEA-3800
Single-circuit Unit Substations	GEA-4300
Package Substations	GEA-4500
Rural Package Substations	GEA-5276

SAVES 8.7%



FIELD-ASSEMBLED TYPE		G-E UNIT SUBSTATION	
MATERIAL AND LABOR	$66,182	MATERIAL AND LABOR	$60,424
OVERHEAD (20%)	13,236	OVERHEAD (20%)	12,085
	$79,418		$72,509

SAVINGS **by installing** G-E UNIT SUBSTATION **$6,909 or 8.7%**

In this typical cost analysis* that shows the obvious advantage of using General Electric Unit Substations purely from an investment standpoint, the labor estimates on both jobs were the minimum, a factor that favored the field-assembled type. As G-E Unit Substations arrive in large, completely-assembled units they are installed faster and easier, with lower labor costs.

Note that 20% overhead was added in both cases. For a comparison of *real costs*, 10% on the G-E Unit Substation against 20% on the field-assembled type would be more reasonable. Overhead is reduced when you order G-E Unit Substations because weeks spent in tedious engineering and detailing individual items are eliminated, at definite savings to you. Another item in favor of the G-E Unit Substation is its fan-cooled rating—442 kva greater than the field-assembled job. At a conservative $5 per regulated kva this gives you further savings in favor of the Unit Substation.

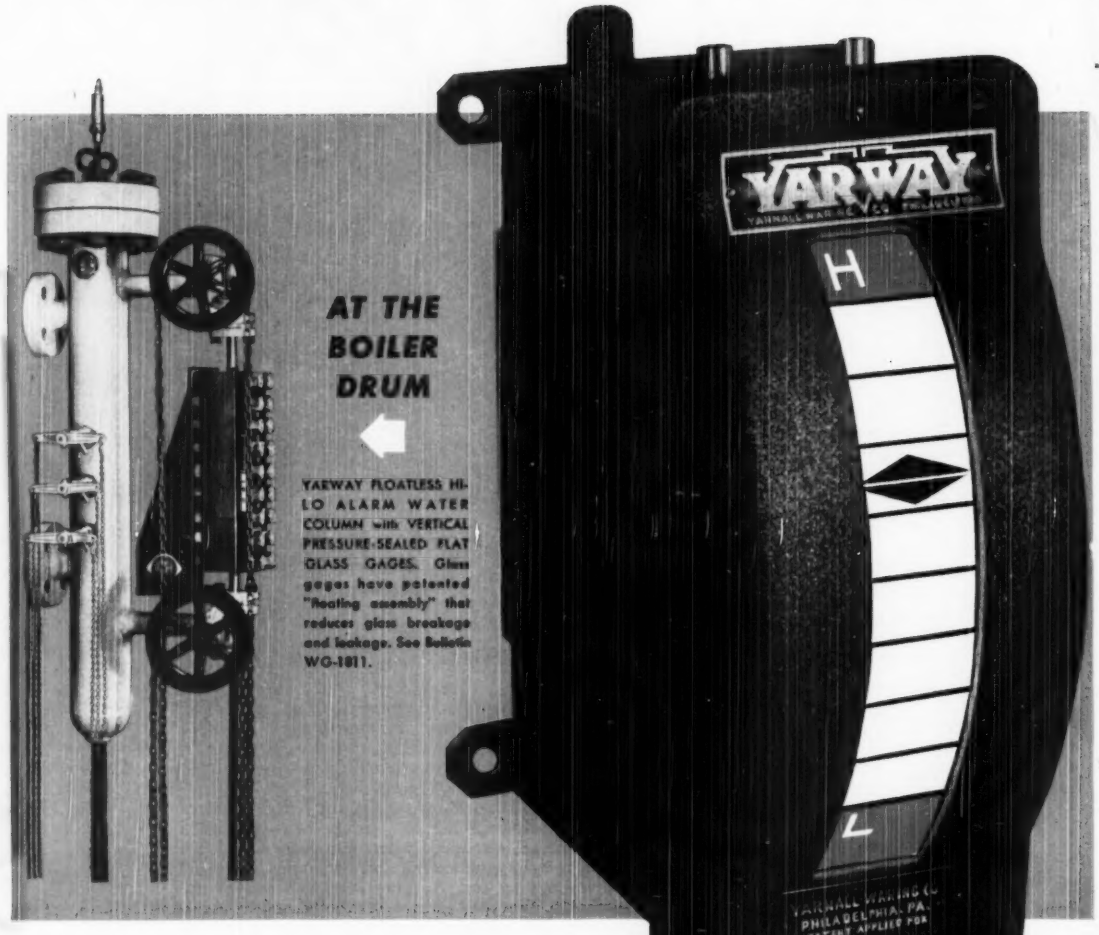
*For one installation in 1949.

MATERIAL AND LABOR	$66,182		MATERIAL AND LABOR	$60,424
OVERHEAD (20%)	13,236		OVERHEAD (10%)	6,042
EXTRA FAN-COOLED CAPACITY	2,210	LET'S EVALUATE		
	$81,628			$66,466

SAVINGS **by installing** G-E UNIT SUBSTATION **$15,162 or 18.6%**

GENERAL ELECTRIC

Boiler Water Indication


AT THE BOILER DRUM
YARWAY FLOATLESS HI-LO ALARM WATER COLUMN with VERTICAL PRESSURE-SEALED FLAT GLASS GAGES. Glass gages have patented "floating assembly" that reduces glass breakage and leakage. See Bulletin WG-1811.
YARWAY
H
L

YARWAY

ON THE LEVEL with a Yarway System

It's accurate! It's where you can see it!

These two most important needs for boiler water level indication are assured with a Yarway system.

Yarway indicating equipment is accurate because it is *operated directly by the boiler water itself.* Yarway Weight-operated Hi-Lo Alarm Water Columns with either Sesure Inclined or Flat Glass Vertical Gages take care of the job at the boiler drum. On the instrument panel or other desired location, Yarway Remote Liquid Level Indicators bring overhead gage readings down to convenient, easy eye-level vision. By use of a Control Unit on the indicator, additional Hi-Lo light or sound alarms can be located at any place in the plant.

The Yarway HI-LO-GRAPH, a panel-mounted *recording* indicator, gives a 24-hour record of boiler water levels.

Yarway engineers will gladly show you how the Yarway Boiler Water Indicating System increases power plant *safety* and *efficiency.*

For the full story on Yarway Indicators, write for a free copy of Yarway Bulletin WG-1822.

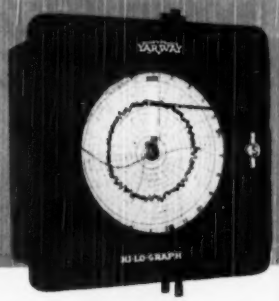
YARNALL-WARING COMPANY, 100 Mermaid Avenue, Philadelphia 18, Pa.

BRANCH OFFICES IN PRINCIPAL CITIES

ON THE INSTRUMENT PANEL

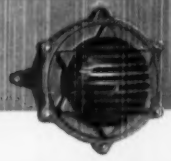
YARWAY REMOTE LIQUID LEVEL INDICATOR, operated directly by the boiler water itself, by the pressure differential between a constant head and the varying head in the boiler drum. Indicating mechanism is never under pressure—no stuffing boxes. See Bulletin WG-1822.

YARWAY HI-LO-GRAPH RECORDER provides not only instant indication but also 24-hour recording of boiler water levels. See Bulletin WG-1830.

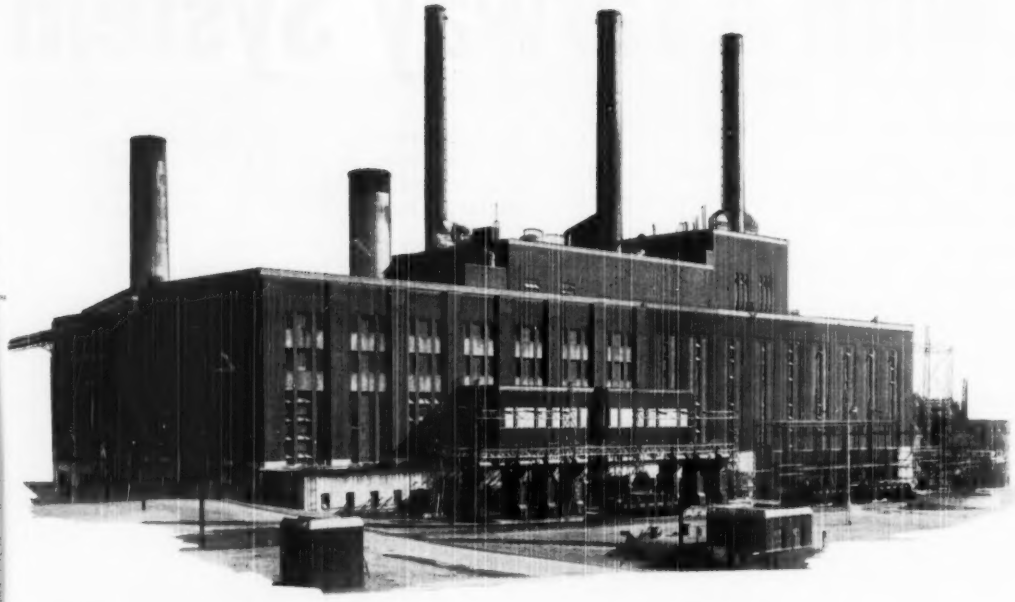


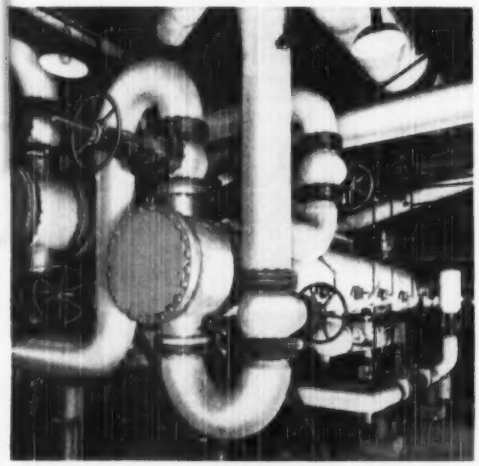
ANYWHERE IN THE PLANT

YARWAY REMOTE HI-LO ALARM SIGNALS, lights or horns. Operated by Control Unit attached to Remote Liquid Level Indicator or Recorder. Any number can be installed, at any desired locations throughout the plant. See Bulletin WG-1822.



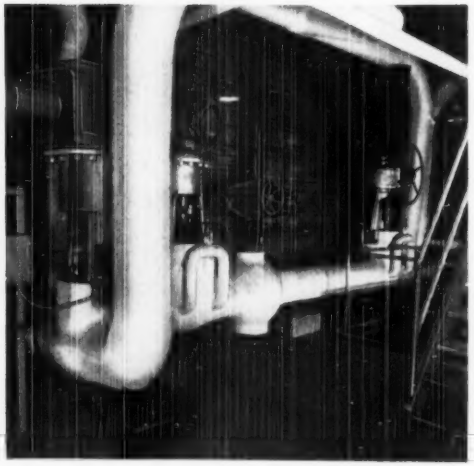
Proved at





Typical installations of Lunkenheimer Steel Valves in the Twin Branch Plant of American Gas and Electric System.

Leadership through Achievement



"Twin Branch"

LUNKENHEIMER VALVES!

THIS pioneer high-pressure, high-temperature power plant, the Mishawaka (Twin Branch) plant of the Indiana and Michigan Electric Company is equipped with a large number of Lunkenheimer Valves. Ranging from low pressure Bronze Globe and Gate Valves to Breech Lock Seal Welded Bonnet Cast Steel Valves for extreme pressures and temperatures, most types of Lunkenheimer Valves are included in the installation.

Lunkenheimer Valves in the original power unit, now nearing the end of the twenty-fifth year in service, as well as subsequently added units, have established notable records for dependability and trouble-free service. The Twin Branch Plant, incidentally, is but one of the plants in American Gas and Electric System equipped with Lunkenheimer Valves.

ESTABLISHED 1862

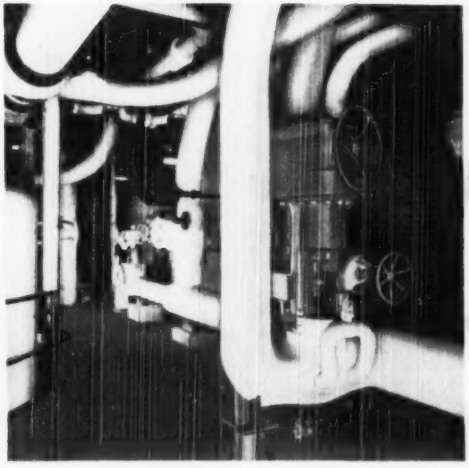
THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO, U.S.A.

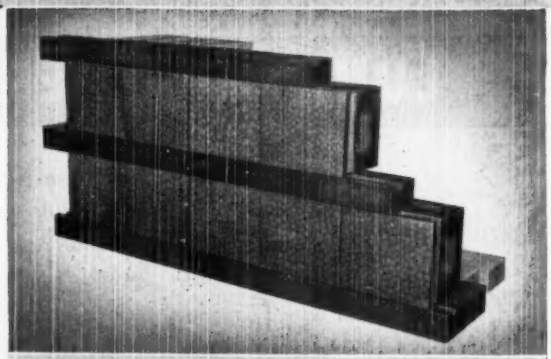
NEW YORK 13 • CHICAGO 6 • BOSTON 10 • PHILADELPHIA 34

EXPORT DEPT. CINCINNATI 14, OHIO, U.S.A.

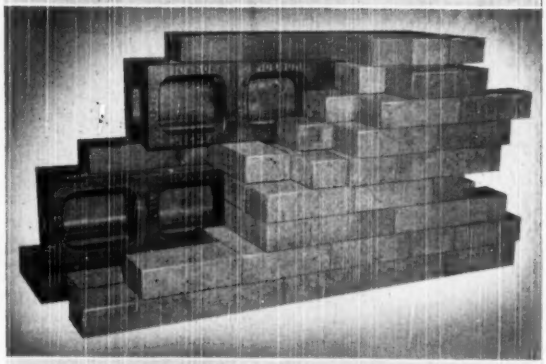


If you want the low cost service that has made LUNKENHEIMER a respected name in the power generation field, Lunkenheimer representatives and sales engineers can give you helpful cooperation. Their wide experience and technical facilities are at your service.

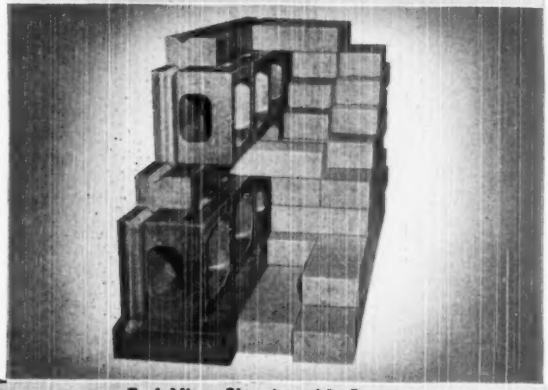
CRYSTOLON *Air Cooled* BLOCKS



Crystolon Blocks and Special 9" Brick Fire Face View



Rear View Showing Hollow Block Design



End View Showing Air Passage

CRYSTOLON

CRYSTOLON is the Norton Company trade-mark for its brand of silicon carbide. CRYSTOLON grain is produced at high temperatures and will stand up well under high heat. In the manufacture of CRYSTOLON brick and air-cooled blocks for boiler furnaces a maximum of silicon carbide is mixed with a minimum of refractory bond to produce a dense, physically strong, highly refractory shape.

NORTON
REFRACTORIES

for *Air Cooled* WALLS in BOILER FURNACES

CRYSTOLON Hollow Blocks are specially designed for the scientific construction of air cooled walls in boiler furnaces. In addition to their unique design, these blocks (like CRYSTOLON Bricks for solid walls) possess the four basic outstanding qualities of silicon carbide. The result is lowered boiler lining cost:

(1) **Unusually high refractoriness.** Bonded CRYSTOLON Shapes are successfully used at temperatures up to 2900°F. (1595°C.).

(2) **Resistance to slag action.** The action of molten slag is tough on any refractory—but CRYSTOLON blocks and bricks are made so dense that slag will not take hold by penetration.

(3) **Resistance to clinker adhesion.** CRYSTOLON blocks and bricks are designed to reduce the adhesion of clinkers to a minimum. If clinkers do adhere to a limited extent, they are easily removed without any damage to the surface of the block or brick.

(4) **Resistance to abrasion.** Silicon carbide is an abrasive material of extreme hardness and, therefore, CRYSTOLON blocks and bricks show remarkable resistance to abrasion—including that caused by the moving fire bed of a stoker-fired furnace.

CRYSTOLON air cooled blocks are designed as a full block having a 9" base or as a half block with a 4½" base. They have a definite relation to the standard 9" CRYSTOLON straight brick and can be used in conjunction with it. In addition there are modifications of the 9" brick shapes, provided with standard tongues and grooves, for use in conjunction with the blocks as both headers and stretchers. The blocks are made with either a blank face or a perforated face having two or four holes.

NORTON COMPANY
WORCESTER 6, MASSACHUSETTS

REPEAT
are the "Proof

REPEAT ORDERS for VULCAN AUTOMATICS

Chicago District Electric Generating Company	3 orders
Cincinnati Gas & Electric Company	2 orders
Consolidated Edison Company of New York	7 orders
Duquesne Light Company	3 orders
Long Island Lighting Company	3 orders
Metropolitan Edison Company	2 orders
Pennsylvania Electric Company	4 orders
Philadelphia Electric Company	5 orders
Rochester Gas & Electric Company	3 orders
Staten Island Edison Company	2 orders

"Proof of the Pudding" lies in repeat orders placed by these important utilities for Vulcan Automatics.

VULCAN *Automatic*

ORDERS of the Pudding"

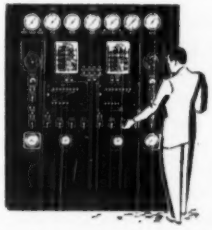
You might try something new because you believe it good. But you don't often buy it again until you've had proof that performance lives up to promises.

So it was with the important central stations on the list. They tried Vulcan Automatic Soot Blowing Systems on faith. They placed repeat orders after experience had proved that Vulcan would:

1) Clean boilers better because the system is engineered for effective blowing in even the least accessible passes. This means higher boiler efficiency, less fuel burned per pound of steam generated.

2) Use less steam or air in blowing because each boiler operates for exactly the proper cleaning interval and no more. Saving steam or air saves money.

3) Save labor because the entire system is operated by pushing one button at the panel. This frees men for other duties, improves operation and cuts operating costs materially.



Write for Bulletin 483—the story of modern Vulcan Automatics

VULCAN SOOT BLOWER DIVISION
Continental Foundry & Machine Company
DUBOIS, PENNSYLVANIA

There's a C-E Stoker that meets your needs exactly

There is no such thing as an "all purpose" stoker. Each type has advantages that are fully realized only when matched with coals of definite characteristics under well-defined operating conditions.

The importance of getting the *right* stoker is readily seen when you consider that the price you pay for it is only a down payment on the continuing cost incident to steam generation. Why? Because the cost of fuel burned every year throughout the useful life of the equipment far exceeds the original purchase price of the stoker. And, at today's coal prices this fact is of paramount interest to you.

Although the complete line of C-E stokers includes seven basic designs, one of the three types shown on the opposite page will prove to be most suitable in 4 out of 5 installations. Each of these stokers represents an outstanding value in its respective field. Each reflects the practical knowledge of fuel and operating conditions Combustion has gained through 65 years experience in stoker design and application . . . with more than 20,000 installations above residence size.

You can assure yourself of top stoker performance by coming to C-E – stoker headquarters – the next time you are in the market. Since C-E engineers have at their disposal every type of stoker equipment they can afford to be completely impartial in recommending the installation which fits your needs *exactly*. B-408

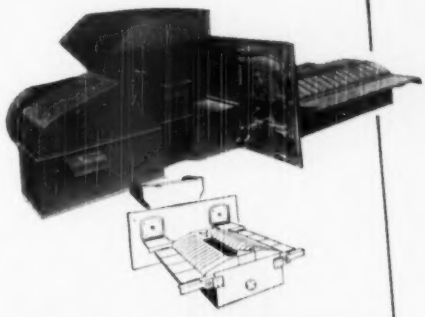
COMBUSTION ENGINEERING

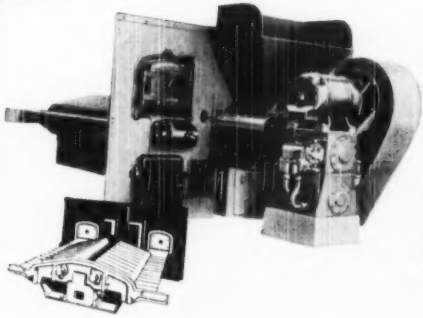
ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

SKELLY STOKER UNIT

Approximate Application Range—20 to 200 boiler hp.

A compact, self-contained underfeed stoker available in designs for burning either anthracite or bituminous coal. An alternate arrangement of fixed and moving grate bars assures lateral distribution of fuel and maintains a clean porous fire. Cantilever dump grates of non-avalanching type simplify ash removal. An integral forced-draft fan, with inlet control, permits positive regulation of air-coal ratio. Sixteen rates of coal feed through variable-speed transmission. Automatic control is standard equipment. Timken bearing equipped. Alemite lubrication throughout.





TYPE E STOKER

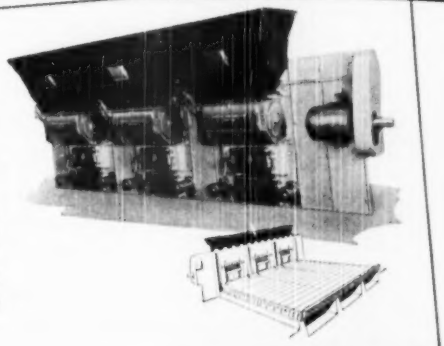
Approximate Application Range—150 to 600 boiler hp.

A single-retort, underfeed stoker designed to burn a wide variety of bituminous coals, particularly those having caking and coking characteristics. The Type E has ram type feed supplemented by a reciprocating sliding bottom. Its grate surface consists of hollow, air-cooled grate bars arranged in an alternately fixed and moving relationship to condition the fuel bed and assure its steady movement to the dump trays which are of the cantilever type. Air supply is under zoned control with provision for introduction of air over the fire. Type E Stokers are available with steam, electric or hydraulic drive.

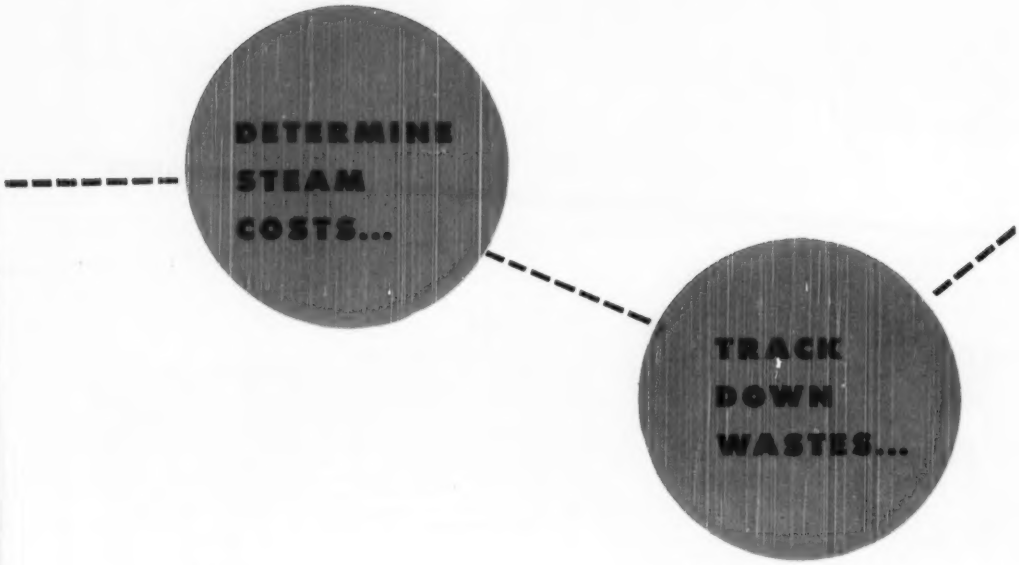
SPREADER STOKER

Approximate Application Range—150 boiler hp. up to units producing 200,000 lb of steam per hr, or more.

The C-E Spreader Stoker is available in both dumping grate and continuous discharge types. This simple, rugged stoker is designed to burn a wide variety of coals. Hopper, feeding and distributing mechanism, variable-speed drive and motor are combined in a compact unit. Rotating spreader blades feed coal into the furnace in crisscrossing streams which assure uniform distribution. Fines are burned in suspension and the rest of the coal is burned on the grate. Grate surface is zoned for regulating air admission and to facilitate cleaning. All parts subject to wear are readily accessible for inspection, adjustment or replacement, when necessary. Rate of fuel feed and air supply may be regulated over a wide range and are readily adaptable to automatic control.



— SUPERHEATER, INC.
200 MADISON AVENUE, NEW YORK 16, N. Y.
C-E



Your costs for distribution and utilization of steam (or other fluid) will be known facts with the installation of a Brown Flow Accounting Meter. And you'll be able to put your finger on leaks and uneconomical operations . . . because the hourly and daily records will let you know, not approximate, what is happening, where it is happening, and when it is happening.

Brown Flow Accounting Systems are producing sensational economies in many plants, repaying the original investment in a very short time. *A Brown Recording Integrating Flow Meter . . . complete for a six inch line . . . costs less than $500.00!*

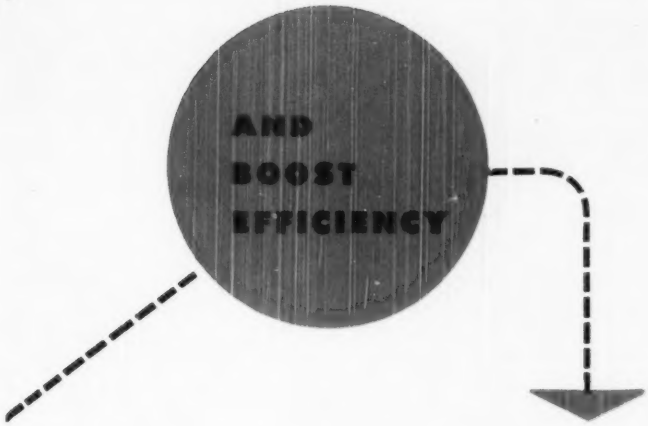
Check, today, on the application of such an accounting system for your processes. Call in your local Honeywell engineer for specific information . . . he is as near as your phone!

COMMERCIAL • RESIDENTIAL • INDUSTRIAL
WORLD'S LARGEST ORGANIZATION FOR ADVANCED INSTRUMENTATION AND CONTROL

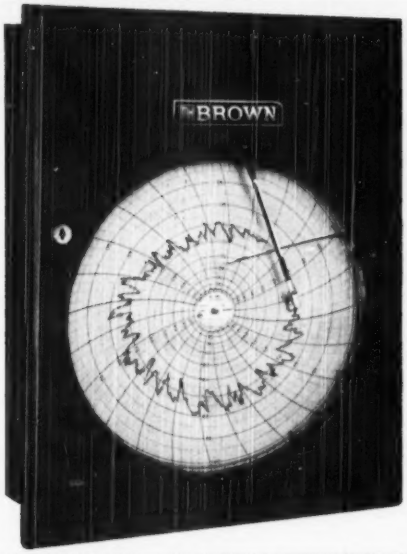
MINNEAPOLIS-HONEYWELL REGULATOR CO. • INDUSTRIAL DIVISION

4490 Wayne Ave., Philadelphia 44, Pa.

Offices in 73 principal cities of the United States, Canada and throughout the world

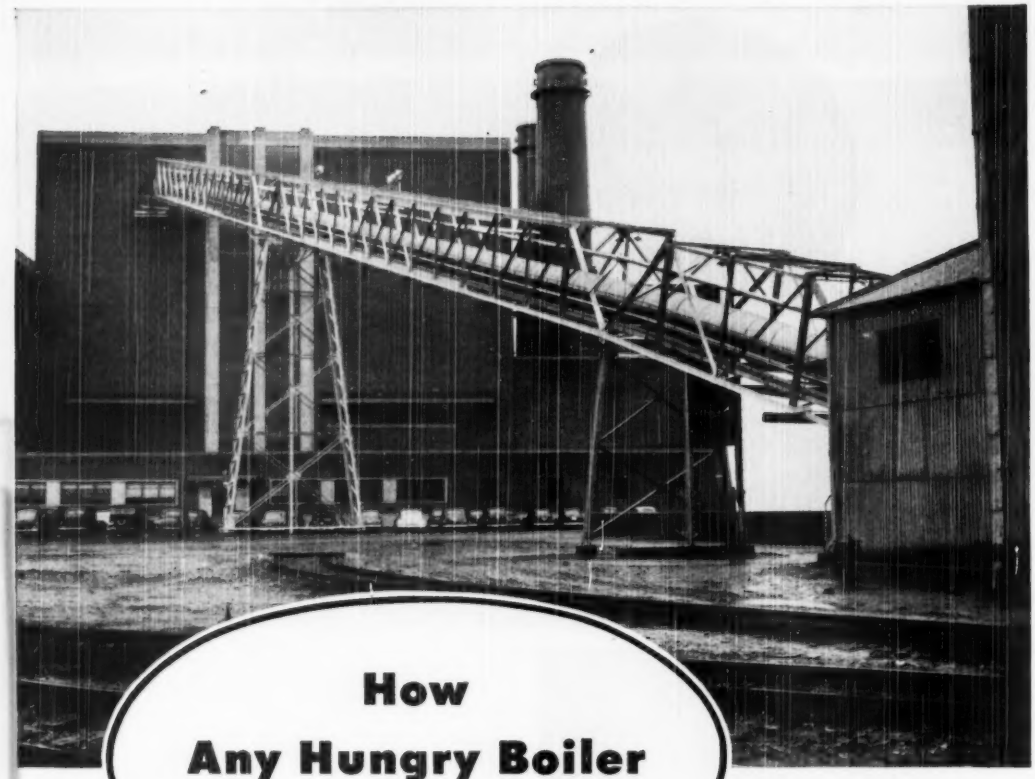


WITH THE BROWN ACCOUNTING FLOW METER



Bulletin 2022, "Brown Flow Meters for Cost Accounting," is complete and informative. A copy will be sent to you upon request. Write today!

Honeywell — *Advanced Instrumentation* FOR BETTER PROCESSING — BROWN



How Any Hungry Boiler is Fed

—by this System Operating at a Carload Every 5 Minutes

Here's a power plant where large scale coal handling operations are required to satisfy a tremendous appetite for power. When this plant reaches full production, the S-A belt conveyor system will be capable of handling and storing coal at the rate of one carload every five minutes . . . 12 carloads an hour. S-A conveyors also store and reclaim over a huge auxiliary outdoor storage area to permit continuous plant operation.

Whether your operations are large like this generating station, or small and comparatively simple, S-A engineers can help you find the most efficient way to handle coal and ash at the lowest cost per ton handled. They have a complete line of handling equipment plus nearly 50 years of engineering experience with all kinds of conveying problems.

POTOMAC ELECTRIC POWER COMPANY
WASHINGTON, D. C.

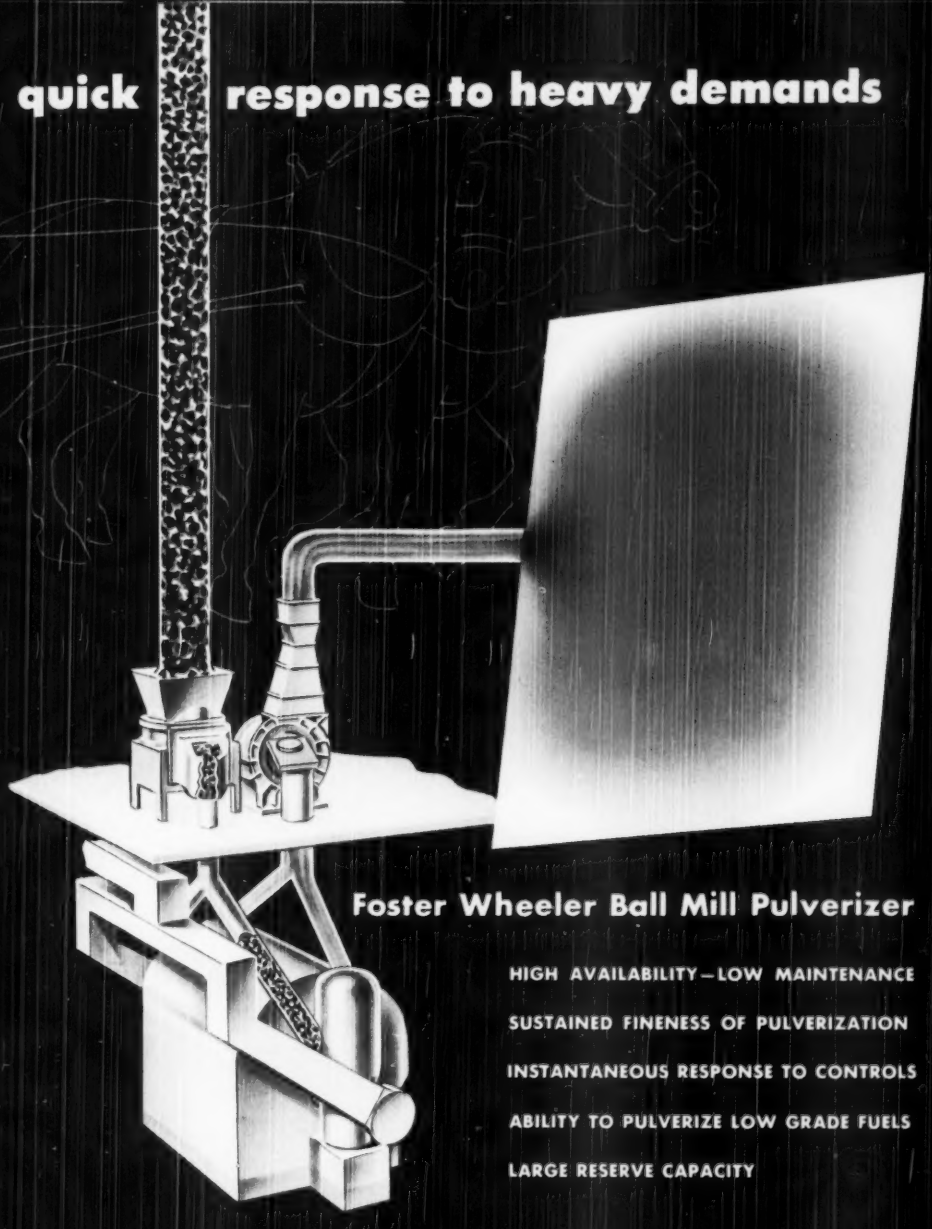
Coal cars are weighed and then emptied by a rotary car dumper discharging to belt feeders which feed to a 320-foot inclined S-A Belt Conveyor. From the breaker house, reduced coal can be diverted to a pivoted boom conveyor for stockpiling on outdoor storage . . . or transferred to the main 370-foot inclined S-A Belt Conveyor for delivery to bunkers. Outdoor storage pile is reclaimed by bulldozer to receiving hoppers and main conveyor for delivery to boiler house bunkers.

STEPHEN S-A DAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

quick response to heavy demands



Foster Wheeler Ball Mill Pulverizer

HIGH AVAILABILITY—LOW MAINTENANCE

SUSTAINED FINENESS OF PULVERIZATION

INSTANTANEOUS RESPONSE TO CONTROLS

ABILITY TO PULVERIZE LOW GRADE FUELS

LARGE RESERVE CAPACITY

The basic qualities of dependability, responsiveness, and capacity for hard work . . . as symbolized by the prize workhorse . . . are also desirable in modern machinery. But it is the added element — *skilled engineering* — that removes us so distantly from the horse age and makes it possible to build machinery like the Foster Wheeler Ball Mill Pulverizer which pulverizes as much as 30 to 40 tons of coal per hour with instantaneous response to load demands.

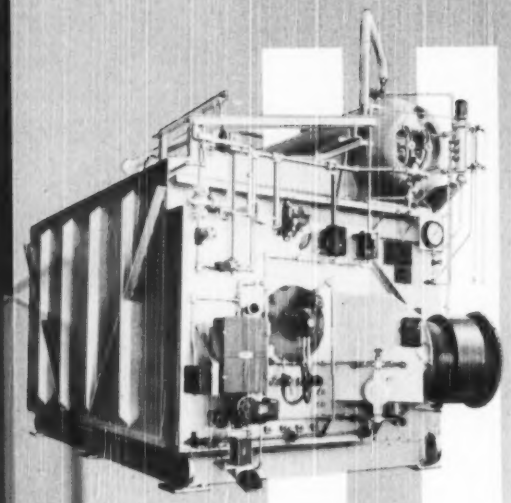
For further information write to:

FOSTER WHEELER CORPORATION • 165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

a small unit with a great background

FOSTER WHEELER PACKAGE STEAM GENERATORS



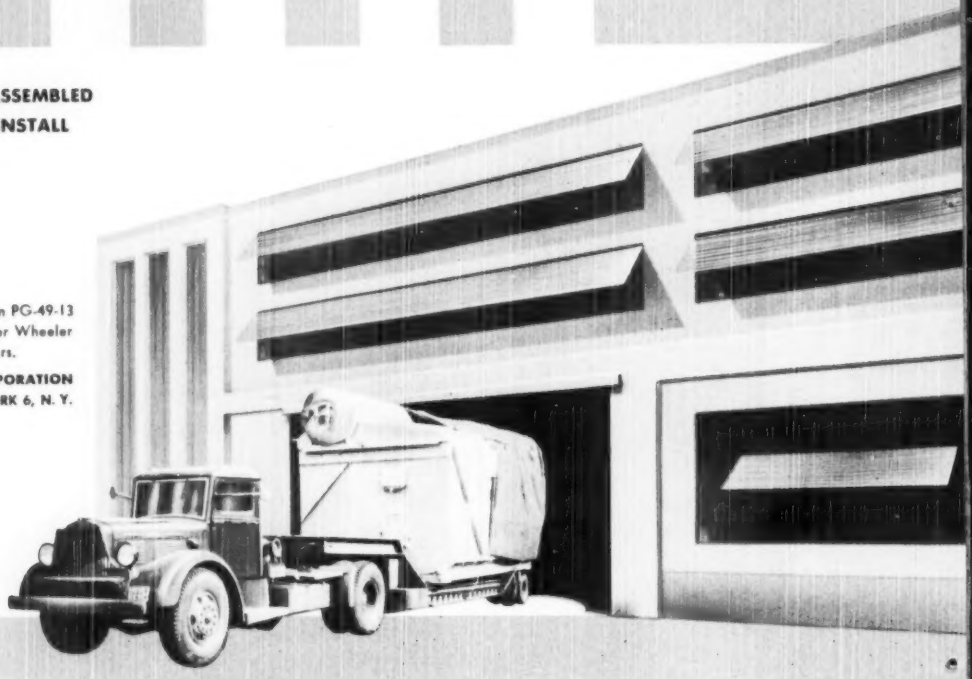
water-tube units embodying the best features of central station and industrial steam plants

The average boiler horsepower per unit of 15,000 installations which were surveyed recently lies between 150 to 175 hp. These units were found to be operating at extremely low efficiencies with poorly coordinated equipment. There was also evidence that erection had been done by unskilled or semiskilled labor.

Could one of these installations be yours?

Provide for your present and future steam plant requirements by installing a scientifically integrated Foster Wheeler Package Steam Generator which *insures continuous steam output under widely fluctuating load demands at low cost and with a minimum of maintenance.* Exclusive Foster Wheeler features affecting casing, combustion controls, insulation and general structure are incorporated in this unique package unit.

FACTORY ASSEMBLED
READY TO INSTALL



Write for a copy of Bulletin PG-49-13 covering all types of Foster Wheeler Package Steam Generators.

FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

CENTRAL POINT OF EFFICIENCY

For over seventy-five years, thousands of central stations all over the world have been proving the efficiency and advantages of central generation and distribution of high and low pressure steam.

For forty years over ten million feet of Ric-wiL Prefabricated Insulated Piping have been used to convey these products with maximum thermal and operating efficiency.

Constant research and product development have provided Ric-wiL Piping with every characteristic necessary to long, top-performance operating life under today's exacting conditions.

The specialized Ric-wiL Engineering Service, backed by forty years' experience in insulated piping systems, supplies technical data, detailed piping drawings, and complete analysis of piping system layouts. This insures lower installation, operation, and maintenance costs to users of Ric-wiL Piping.

At no cost or obligation to you, the Ric-wiL representative nearest you will be glad to discuss the advantages of Ric-wiL Systems as applied to your specific operation.

For full technical information on Ric-wiL Insulated Piping Systems, call or write the Ric-wiL office nearest you or Department 11-CA in Cleveland, Ohio.

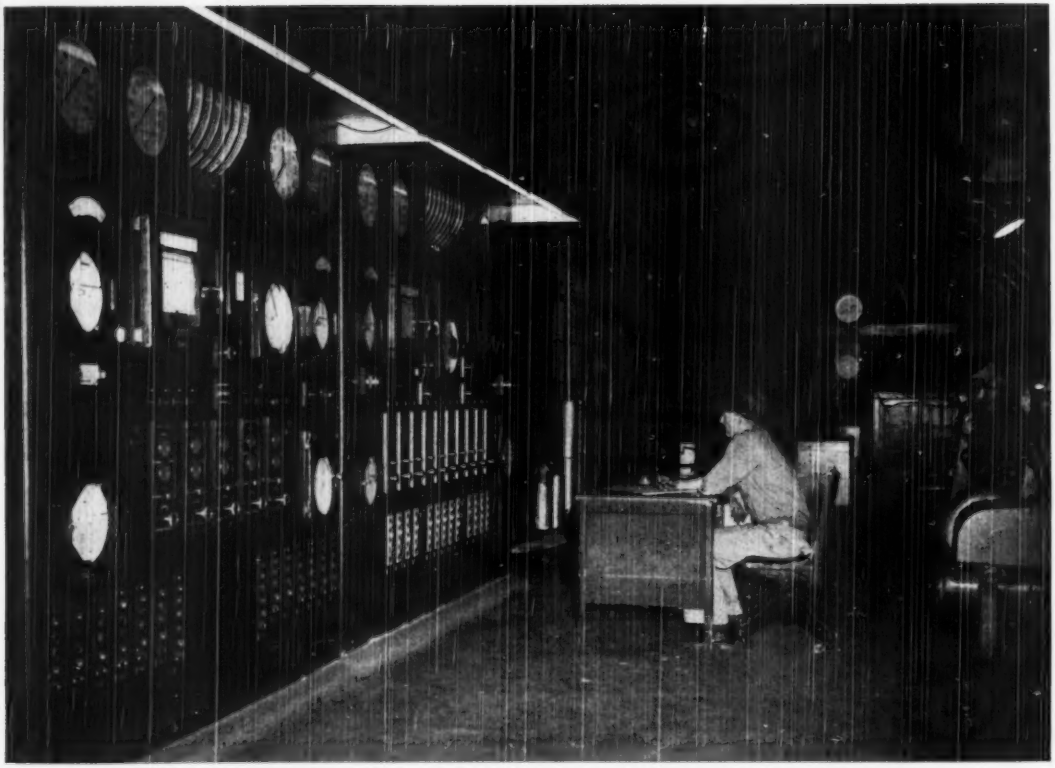
Ric·wiL
INSULATED PIPING SYSTEMS

OVERHEAD — THE RIC-WIL COMPANY · CLEVELAND, O. — UNDERGROUND

FOR FORTY YEARS THE GREATEST NAME IN INSULATED PIPING SYSTEMS

● THE MUNICIPAL ELECTRIC PLANT
of MUSCATINE, IOWA

Knows the Value of *Automatic*



Republic automatic boiler control and instrument panels at Muscatine Municipal Electric Plant

Republic regulator controlling fuel feed to stokers.

Control

● In 1941 the Municipal Electric Plant at Muscatine, Iowa, installed a modern 100,000 lb. per hr. steam generator. In 1948 a second boiler rated at 160,000 lb. per hr., 650 psi. was added.

In any steam electric generating plant, electric power rates and steam cost go hand-in-hand. Low steam cost however, is not the result of efficient boiler design alone. It is determined by the degree with which your method of boiler control takes full advantage of those economies which have been "built-in" the boiler and its auxiliaries.

To realize all the operating advantages of these modern boilers, each was equipped with a Republic automatic combustion and feed water control system at the time of installation. Built into the Republic control system are the many important features that enable it to fulfill all the conditions of theoretically perfect boiler control and still meet all the demands of everyday operation.

The installation of Republic automatic controls on your boiler (or boilers) will enable you to: —

SAVE FUEL by automatically maintaining highest combustion efficiency.

INCREASE STEAM OUTPUT by operating the boilers at test efficiency 24 hours a day, 7 days a week.

CONSERVE MANPOWER by automatically performing the many routine repetitive adjustments.

REDUCE OUTAGES by maintaining uniform operating conditions and thereby prevent the chain-of-event type of trouble that frequently develops as a result of incorrect boiler operation.

An automatic boiler control system, as designed and built by Republic, will help you meet today's need for more steam at lower cost.

Find out about Republic control systems. One of our engineers will be glad to consult with you at any time. Write us today.

REPUBLIC FLOW METERS CO. ● 2240 DIVERSEY PARKWAY • CHICAGO 47, ILLINOIS

*POUR POINT

Today, it is essential to use the best lubricants money can buy — for maximum efficiency . . . lowest operating cost. That's why more and more production machinery is being lubricated with Tycol oils and greases.

Whatever your lubricating need — for turbine, steam engine, mine car or tipple, textile mill, stationary Diesel or locomotive — there's a Tycol high quality oil or grease exactly suited to your specific need.

In developing this comprehensive line, Tycol subjects each individual oil and grease to rigid tests during manufacture. This control assures the required lubrication characteristics — *POUR POINT, viscosity, color, penetration, to name a few — for maximum performance of that particular product.

Let us show you the extra value in every measure of Tycol oil and grease. Write your nearest Tide Water Associated office today.

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C. • Pittsburgh • Philadelphia • Chicago Detroit • Tulsa • Cleveland San Francisco • Toronto, Canada

TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N. Y.

*LEARN WHAT THIS PRODUCT CHARACTERISTIC MEANS TO YOU — READ "LUBRICANIA"
This informative handbook, "Tide Water Associated Lubricania," gives clear, concise descriptions of the basic tests used to determine important properties of oils and greases. For your free copy, write to Tide Water Associated Oil Company, 17 Battery Place, New York 4, N. Y.

REFINERS AND MARKETERS OF VEEDOL — THE WORLD'S MOST FAMOUS MOTOR OIL

PROTECT STEAM and AIR RODS AGAINST WEAR WITH

ANCHOR "SECURITY WEDGE" PACKING

SECURITY WEDGE packing is an ideal combination fabric and metallic packing for reciprocating steam and air rods, steel and cast iron plungers. The metal wedge forms a perfect anti-frictional metallic surface against the rod or plunger. The continuous segmental wedge center is surrounded by a substantial asbestos cloth channel, to which it is securely fastened. The asbestos channel insures to the finished packing the resiliency to hold the metallic member in proper contact with the moving rod at all times. This packing can be supplied in either ring or spiral form and can be depended upon to give long service with low friction and without wear to the rod on which it is used.

Recommended for the following: Piston rods of high speed and Corliss engines, large and small valve stems, expansion joints, oil rods, plungers, steam hammers, shotgun feeds, stock pumps in paper mills and for all other stuffing box requirements where a good grade of semi-metallic packing is required.

BRANCH OFFICES

BALTIMORE, MD.
BOSTON, MASS.
BUFFALO, N. Y.
CINCINNATI, OHIO
CHICAGO, ILL.
CLEVELAND, OHIO
DAYTON, OHIO
DETROIT, MICH.
HOUSTON, TEX.
INDIANAPOLIS, IND.
LOS ANGELES, CAL.
MILWAUKEE, WIS.
MONTREAL, CANADA
NEW ORLEANS, LA.
NEW YORK, N.Y.
PHILADELPHIA, PA.
PITTSBURGH, PA.
SAN FRANCISCO, CAL.
SEATTLE, WASH.
SPOKANE, WASH.
ST. LOUIS, MO.
TOLEDO, OHIO
WILMINGTON, CAL.

THE ANCHOR PACKING COMPANY

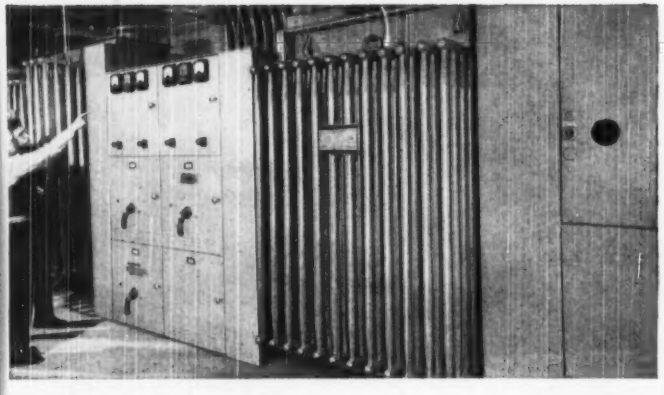
GENERAL OFFICES: PHILADELPHIA, PA.

FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

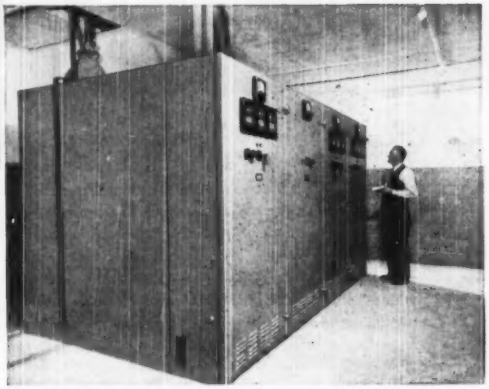
FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE

Scott GETS RELIABILITY

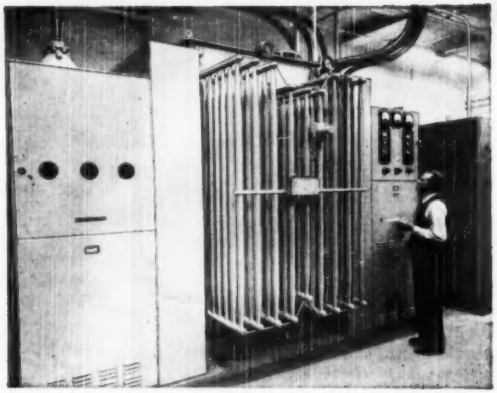
G-E LOAD-CENTER



Double-ended load-center unit substation with 1500 and 1000 kva transformers. This unit receives incoming power at 13.2 kv and distributes it at 600 volts to steam plant auxiliaries and finishing equipment. Blades of air interrupter switch (right) are clearly visible through window, another safety feature of G-E unit substations.



R. E. Neilson, Electrical Superintendent of Marinette Paper Co., looks over the G-E 15-kv metal-clad switchgear that handles the 13.2 kv incoming power through three Magne-blast power circuit breakers. Metal-clad switchgear is neat in appearance, saving in space, and offers operating safety to personnel. Additional sections can be added for future expansion with a minimum of bother and expense.



General Electric 1500 kva load-center unit substation that supplies power to No. 4 paper machine. Air interrupter switch on the primary is easy to operate, blades are easy to see. Air circuit breakers on the low-voltage side are rated 1600 amperes, have plenty of "IC" (Interrupting Capacity) to handle all short circuits. Note entire load center is metal-enclosed, thus offering operating safety to personnel.

PLUS FLEXIBILITY WITH ···

UNIT SUBSTATIONS

"We can't afford to take chances with an inadequate power system because a breakdown would mean a major loss in both production and time. Our General Electric power-distribution system gives us the reliability and flexibility we need. If there should be a major fault we'd still be able to operate at slightly reduced capacity.

"The installation of this equipment was made without any trouble and we quickly changed over from our old system on a three-day weekend."

R. E. Neilson, Electrical Superintendent
Marinette Paper Co. (subsidiary of Scott Paper Co.)
Ft. Edward, New York

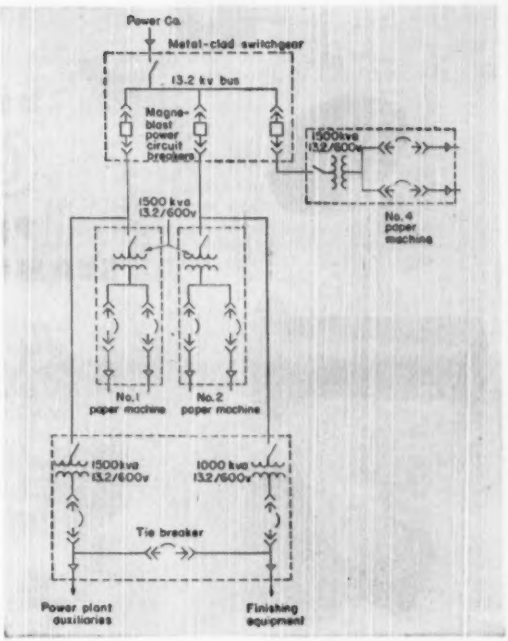
CHECK THESE FEATURES OF G-E LOAD CENTERS . . .

SAVE TIME by eliminating weeks spent over drawing boards detailing individual items. G-E factory-assembled unit substations are quickly and easily installed with lower material and labor costs than required for "piece-meal," makeshift affairs. No last minute "alterations" with hack-saws and cold chisels when you order G-E unit substations.

NEAT APPEARANCE Note the smooth, integrated appearance of these G-E unit substations . . . no more gawky, "old style" stovepipe connections between transformer and switchgear.

INVESTIGATE TODAY how General Electric unit substations can be used in your plant for efficient, flexible power distribution. Contact your G-E sales representative for further information, and write today for the helpful bulletins listed below. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GEA-3592 Load-center Unit Substations
GEA-3758 Load-center Power Distribution
GEA-3083 Metal-clad Switchgear



Here's the one-line diagram for Marinette Paper's Ft. Edward installation. The tie breaker on the double-ended unit substation makes it possible to shift the power supply in case of a primary fault, thus assuring continuous production at reduced capacity.

Metal-clad switchgear distributes the 13.2 kv incoming power to four G-E load-center unit substations where the high voltage is stepped down to 600 volts for utilization—right at the center of the load area. This eliminates long, costly secondary feeders.

The Scott installation is a complete General Electric project—one source of responsibility plus the very best in co-ordinated planning, engineering, manufacturing, and service facilities to give maximum savings and efficiency to the customer.

Be sure to see the "More Power to America" full-color sound slide-film "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.

GENERAL ELECTRIC

TO DO A BETTER PIPING JOB...

USE

GLOBE

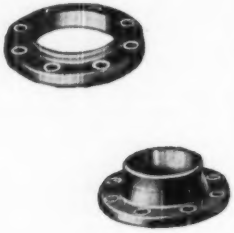
PRECISION PROCESS SEAMLESS WELDING FITTINGS

Your preference for Globe Welding Fittings is supported by a source of supply with exceptional qualifications. Specialized metallurgical experience and facilities gained in years of steel tubing manufacture enable Globe to produce welding fittings by a precision process that yields a superior product.

Send for the Globe Welding Fittings Catalog No. 501.

GLOBE STEEL TUBES CO., Milwaukee 15, Wisconsin

Chicago — Cleveland — Detroit — New York — Philadelphia — St. Louis — Tulsa — Houston — Denver — San Francisco — Glendale, Calif.



Producers of Globe Seamless Stainless Steel Tubes —Gloweld Welded Stainless Steel Tubes—Carbon — Alloy — Seamless Steel Tubes — Globeiron Seamless High Purity Ingot Iron Tubes and Pipe.

SIZE RANGE OF GLOBE SEAMLESS WELDING FITTINGS

Description of Fitting	Standard Weight (Schedule 40)	Extra Strong (Schedule 80)	(Schedule 160)	Double Extra Strong
Elbows 45° Long Radius	½ in. to 24 in.	¾ in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.
Elbows 90° Long Radius	½ in. to 24 in.	¾ in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.
Elbows 90° Short Radius	1 in. to 24 in.	1½ in. to 24 in.	- - -	- - -
Returns 180° Long Radius	½ in. to 24 in.	1 in. to 24 in.	1 in. to 12 in.	3 in. to 8 in.
Returns 180° Short Radius	1 in. to 24 in.	1½ in. to 24 in.	- - -	- - -
Reducers (Concentric and Eccentric)	1 x ⅜ in. to 24 x 20 in.	1 x ⅜ in. to 24 x 20 in.	1 x ⅜ in. to 12 x 10 in.	1 x ⅜ in. to 12 x 10 in.
Tees Straight	¼ in. to 24 in.	¼ in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.
Tees Reducing Outlet	¼ in. to 24 in.	¼ in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.
Stub Ends Lap Joint	1 in. to 24 in.	1 in. to 24 in.	- - -	- - -
Caps	1 in. to 24 in.	1 in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.

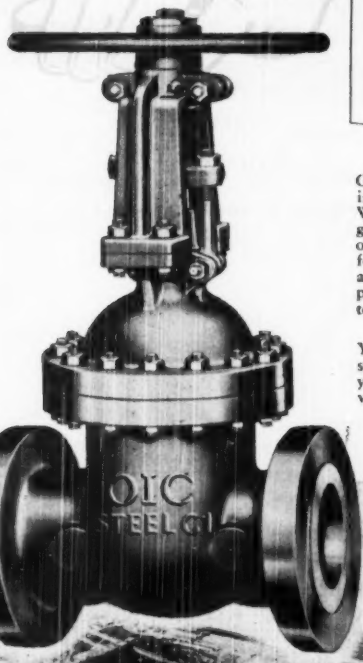
Flanges available 1 inch to 24 inches in all weights

Serving

THE PACE-SETTERS OF INDUSTRY

OIC

SETS THE PACE IN VALVES



GENERAL ELECTRIC uses OIC valves on many of the intricate processing operations at its huge Schenectady Works, shown below. The heavy construction of OIC gate, globe, angle and check valves provides plenty of safety margin for every industrial installation. See for yourself why so many of the leaders of industry are turning to OIC for reliable solutions to their valve problems. Contact your OIC distributor. Write direct to OIC for your copy of the new 1950

VALVE CROSS REFERENCE CHART

You can make your trial applications of the pace-setting line with the help of this handy chart. It offers you information on the *right* OIC figures to replace valves now installed in your plant.

THE OHIO INJECTOR COMPANY

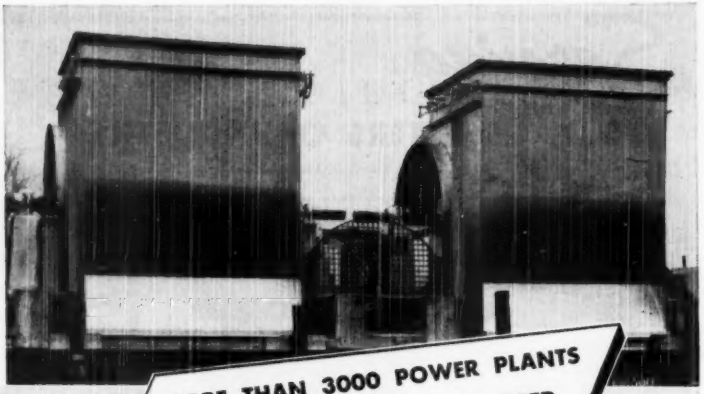
221 MAIN STREET • WADSWORTH, OHIO

0-350-5

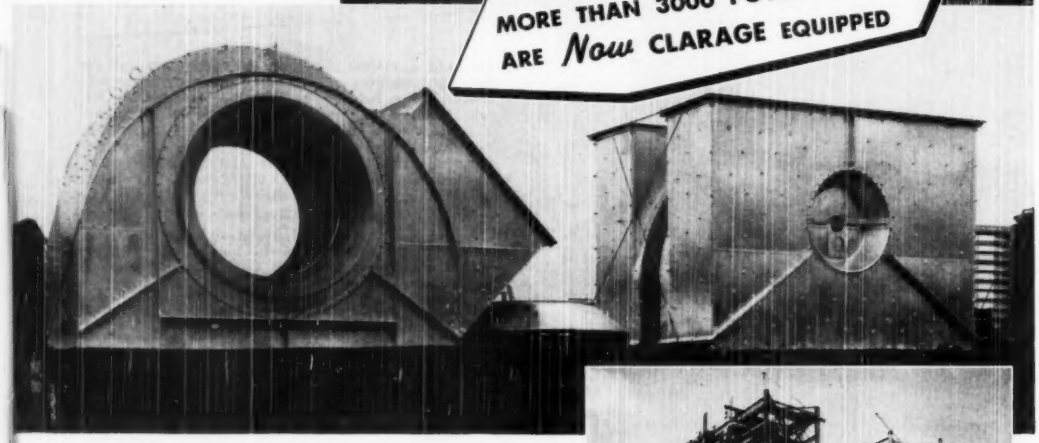
OIC **VALVES**

FORGED STEEL • CAST STEEL • IRON • BRONZE

Headed South but NOT on Vacation



MORE THAN 3000 POWER PLANTS ARE *Now* CLARAGE EQUIPPED



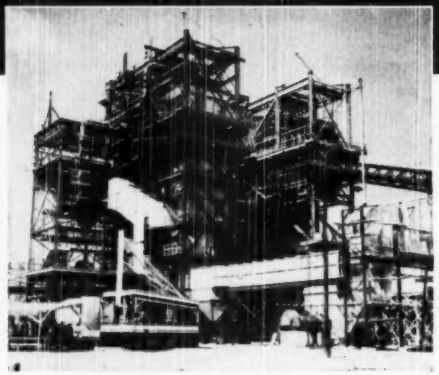
CAROLINA POWER & LIGHT *installs* "HEAVY-DUTY" *Mechanical Draft Fans*

Again Clarage HEAVY-DUTY equipment is chosen for a large and important job!

Pictured above are the two forced draft and one of the two induced draft fans furnished for the new Lumberton (North Carolina) 120,000 horsepower steam electric generating plant of the Carolina Power & Light Co. Photos show fans aboard cars ready for shipment from our plants in Kalamazoo.

Each forced draft fan has a capacity of 158,300 c.f.m. at 10.3" pressure; each induced draft fan, 229,300 c.f.m. at 13.4" pressure and 320° F. The induced draft fans are of record large size.

Wheels, housings, bearings, supports, dampers — *all parts* of Clarage mechanical draft equipment are HEAVY-DUTY construction beyond customary practice. If you want the best in the market, consult with us!



September 30, 1949 at the Lumberton plant — the day the first 60,000 horsepower unit was placed in service. Second 60,000 horsepower unit scheduled for service June, 1950. Clarage fans and Babcock & Wilcox steam generating equipment serve both units.

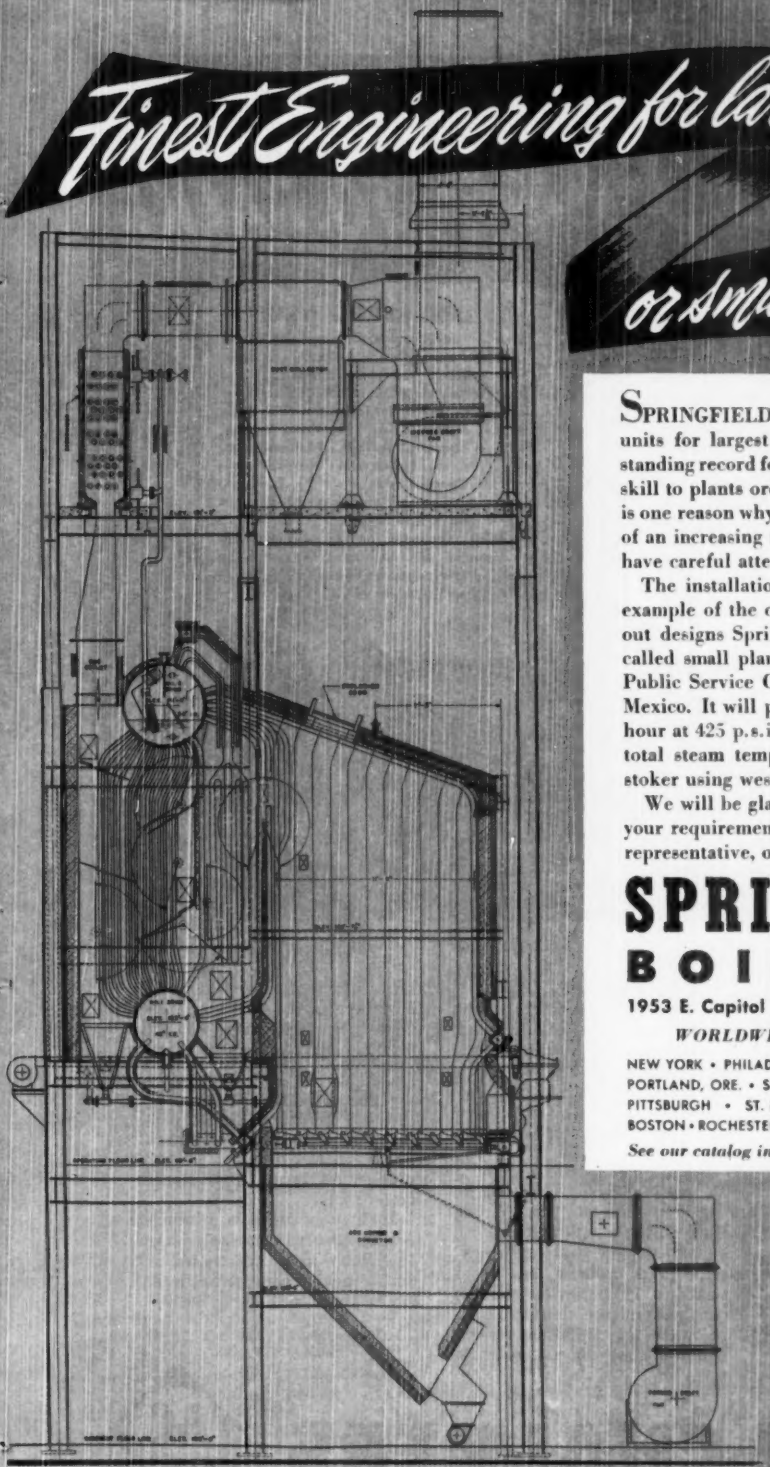
CLARAGE

—HEADQUARTERS for Air Handling and Conditioning Equipment

CLARAGE FAN COMPANY

Sales Engineering Offices in All Principal Cities

Finest Engineering for large . . . or small . . .



Location: Raton Public Service Company, Raton, New Mexico
Consulting Engineers: Burns & McDonnell, Kansas City, Mo.

SPRINGFIELD is a builder of steam generating units for largest plants, but it also has an outstanding record for applying the same engineering skill to plants ordinarily classified as small. This is one reason why Springfield has been the choice of an increasing number of engineers anxious to have careful attention given to their jobs.

The installation shown at the left is a typical example of the clean, modern, carefully worked out designs Springfield is producing for the so-called small plant . . . this unit is for the Raton Public Service Company located at Raton, New Mexico. It will produce 35,000 lbs. of steam per hour at 425 p.s.i. operating pressure and 750° F. total steam temperature. Firing is by spreader stoker using western coal.

We will be glad to submit a proposal covering your requirements. See your nearest Springfield representative, or write.

SPRINGFIELD BOILER CO.

1953 E. Capitol Ave., Springfield, Illinois, U.S.A.

WORLDWIDE SALES AND SERVICE

NEW YORK • PHILADELPHIA • WASHINGTON, D.C. • DETROIT
PORTLAND, ORE. • ST. PAUL, MINN. • HOUSTON • CHICAGO
PITTSBURGH • ST. LOUIS • KANSAS CITY, MO. • SEATTLE
BOSTON • ROCHESTER, N.Y. • MEXICO, D.F. • *Export:* READING, PA.

See our catalog in SWEET'S

CHECK WITH YOUR CONSULTING ENGINEER ON YOUR MODERNIZATION AND NEW PLANT PROJECTS

Pair of Aces —BACK TO BACK!

ALLIS-CHALMERS BOILER FEED PUMP

The barrel pump, below, is one of three types we build for boiler feed service. The various features of this pump have been exhaustively tested and proved satisfactory for highest pressure requirements.

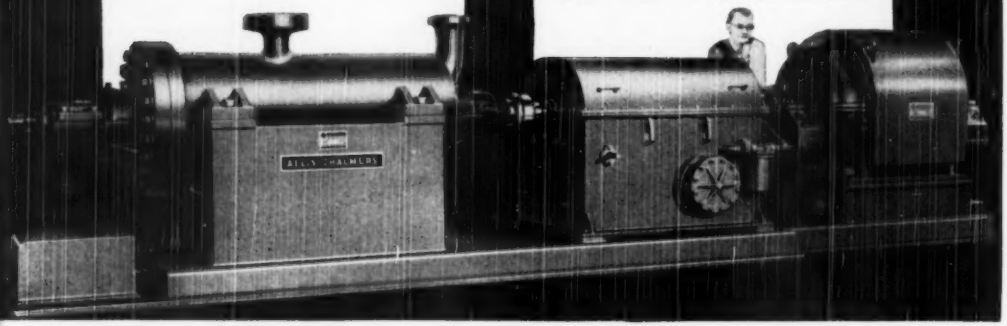
▶Back-to-back arrangement of stages and double volutes assure good axial and radial balance for high heads per stage. ▶Split inner casing simplifies maintenance. ▶Main horizontal joint of inner casing uses full hydraulic discharge to keep joint in compression. ▶Special design reduces possibility of flashing. ▶Uniform metal section thickness throughout volute casing equalizes expansion.

A-C 2-POLE MOTOR & CONTROL

The main thing you pay-for and want in a boiler-feed pump drive is *reliability* . . . continuity of service with minimum time-out!

Here is how you get it in Allis-Chalmers two-pole motors: ▶Extra insulation protection built into the stator winding. ▶Improved bearing design eliminates oil leakage. ▶Bracket (housing) bearing construction results in easier mounting and alignment, greater rigidity. ▶Special, non-embrittling copper used in rotor rods. Rods silver brazed to end rings.

Available for indoor or outdoor application — drip-proof or splash-proof; water-cooled; tube-type totally-enclosed fan-cooled; or pipe-ventilated with *matching* Allis-Chalmers control.



HERE'S A COMBINATION that's hard to beat . . . a quality boiler feed pump, reliable 2-pole motor, and control — all Allis-Chalmers-*built* and *backed!*

CHOICE OF 3 TYPES OF PUMPS

At the pump end, depending on the head, capacity and pressure conditions you are figuring, you can select from 3 different designs:

☞ the new barrel-type, for larger steam stations operating against the higher pressures, 1200 to 2500 lbs; 300 to 2000 gpm.

☞ the "Doubleton", for pressures between 1200 and 1800 p.s.i.

☞ or the standard Type "M", for pressures usually under 1200 p.s.i.

READ WHAT USERS SAY

Regardless of which type of pump you finally select, it will keep your maintenance costs down to a rock-bottom figure. Here's what power plant people, themselves, say.

After 45,000 hours, "No measureable wear on shaft sleeves, rings or internal parts." 1250 p.s.i., 735 gpm pumps at an Eastern utility.

After 82,000 hours, "Not .001 in. wear on any internal part." 6 x 4, 5-stage pumps at Midwest utility.

"Only .002 in. wear on rings" after 8 years operation on pumps installed in 1937. On the strength of this performance, this Ohio utility re-ordered three 1800 p.s.i. pumps.

And on three, 800 hp, two-pole motors driving boiler feed pumps in a Midwest utility, "In over 20 years of uninterrupted service we've had to order replacement parts twice at a total cost less than $12 a year!"

GET AN ALLIS-CHALMERS "PUMPING PACKAGE"

If you want this kind of performance in your power plant, get in touch with an A-C pump application engineer today.

He'll show you how a complete Allis-Chalmers "Pumping Package" . . . pump, motor and control . . . can keep you time, trouble and money ahead in the long haul.

A-2998

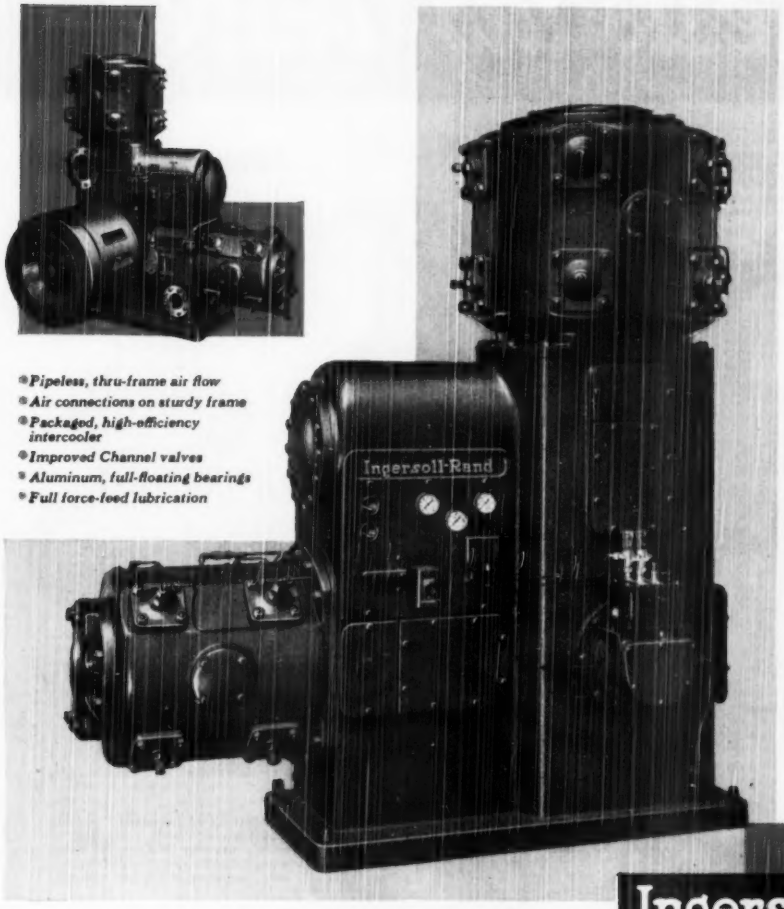
ALLIS-CHALMERS, 952A SO. 70 ST. MILWAUKEE, WIS.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

HERE'S A *NEW IDEA* IN ELECTRIC-DRIVEN AIR COMPRESSORS

that means lower costs of Installation, Operation and Maintenance



- *Pipeless, thru-frame air flow*
- *Air connections on sturdy frame*
- *Packaged, high-efficiency intercooler*
- *Improved Channel valves*
- *Aluminum, full-floating bearings*
- *Full force-feed lubrication*

A Packaged
"L" DESIGN

THE SIMPLEST
MOST COMPACT
MOST ACCESSIBLE
MOST ECONOMICAL
READY-TO-RUN
HEAVY-DUTY
CROSSHEAD-TYPE

TWO-STAGE
80 to 125 psi

SIZES
125 to 350 hp

Ingersoll-Rand

XLE

507-1

The XLE incorporates a "new look" and a new idea in air-compressor design. It is a heavy-duty, well-balanced, easy-to-keep-clean machine that can be installed with an absolute minimum of effort, time, and cost . . . on a minimum of foundation.

Simplicity of XLE construction, and advanced-design features such as aluminum-alloy full-floating bearings that require no adjustments in a sealed, dust-tight crankcase, result in lower-cost maintenance and a higher degree of dependability.

The XLE is a highly efficient compressor built for continuous, full-load operation, and is ideal for factories, railroad shops, mines, powerhouses, and large construction jobs. It is particularly suitable wherever skid-mounting, factory floor, or ground conditions require a well-balanced machine.

FOR MORE INFORMATION on XLE Air Compressors, phone or write the Ingersoll-Rand office nearest you, or write . . .
INGERSOLL-RAND, 11 Broadway, New York 4, N. Y.

ROCK DRILLS • AIR & ELECTRIC TOOLS • OIL & GAS ENGINES • PUMPS • TURBO BLOWERS

Bronze, Iron, Steel Resisting Valves-

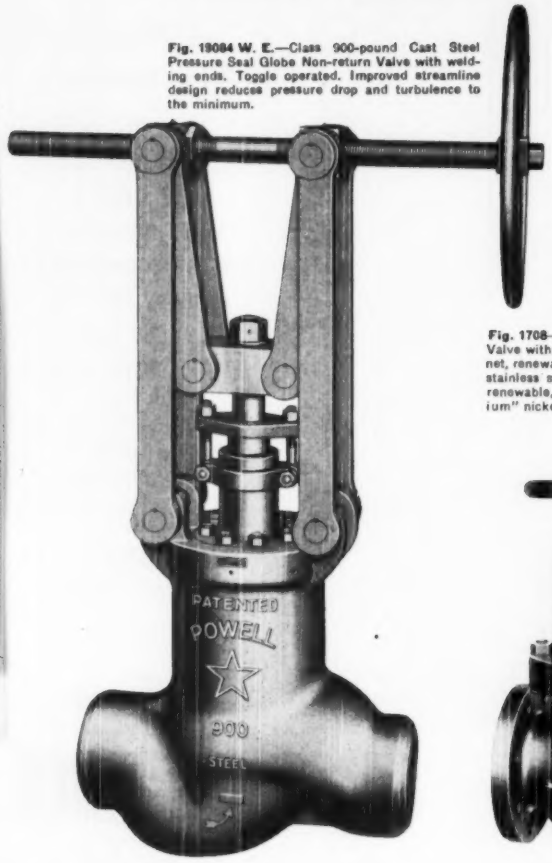


Fig. 19084 W. E.—Class 900-pound Cast Steel Pressure Seal Globe Non-return Valve with welding ends. Toggle operated. Improved streamline design reduces pressure drop and turbulence to the minimum.

Fig. 1708—200-pound Bronze Globe Valve with screwed ends, union bonnet, renewable, specially heat treated stainless steel seat and regrindable, renewable, wear-resisting "Powellium" nickel-bronze disc.

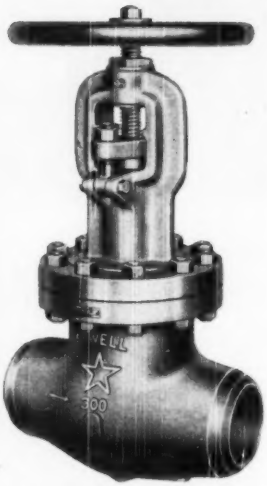


Fig. 3031 W. E.—Class 300-pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke.

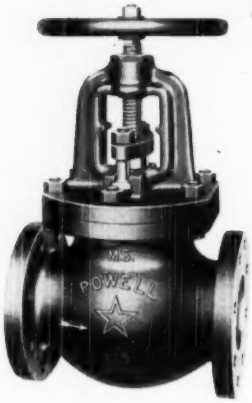


Fig. 241—Large 125-pound Iron Body Bronze Mounted Globe Valve. Sizes 2" to 16", incl. Has outside screw rising stem, bolted flanged yoke and regrindable, renewable bronze seat and disc.

POWELL

and Corrosion-
POWELL MAKES THEM ALL!

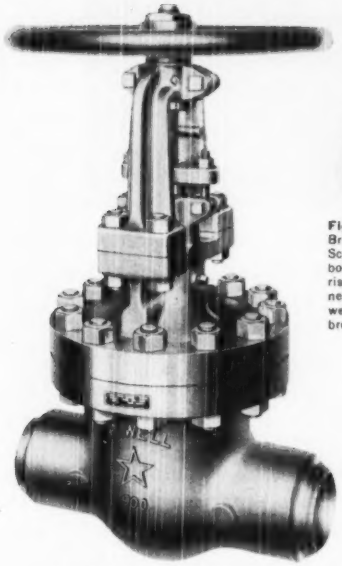


Fig. 9003 W. E. — Class 900-pound Cast Steel Gate Valve with welding ends, outside screw rising stem, bolted flanged yoke and tapered solid wedge.

Fig. 375 — 200-pound Bronze Gate Valve. Screwed ends, union bonnet, inside screw rising stem and renewable "Powellium" wear-resisting nickel-bronze disc.

When you come to ONE SOURCE, you simplify your valve buying—and stocking of spare valves and parts—for your entire flow control system.

Powell Bronze, Iron, and Steel Valves are second to none in giving long, trouble-free service. And when it comes to Special Design and Alloy Valves for Corrosion Resistance, Powell is the acknowledged leader. In fact, Powell makes the *only* COMPLETE line of these valves available to Industry today.

Fig. 1314-A — Class 1500-pound Steel Integral Bonnet "Y" Valve. Also made in Globe and Angle patterns.

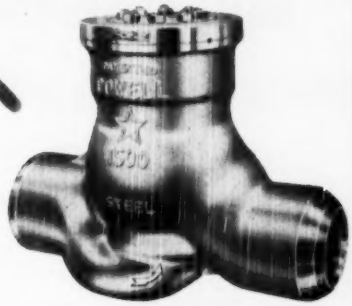


Fig. 11365 W. E.—Class 1500-pound Cast Steel Pressure Seal, Piston-guided, Horizontal Lift Check Valve with welding ends. Streamline design permits maximum flow through valve with minimum pressure drop.

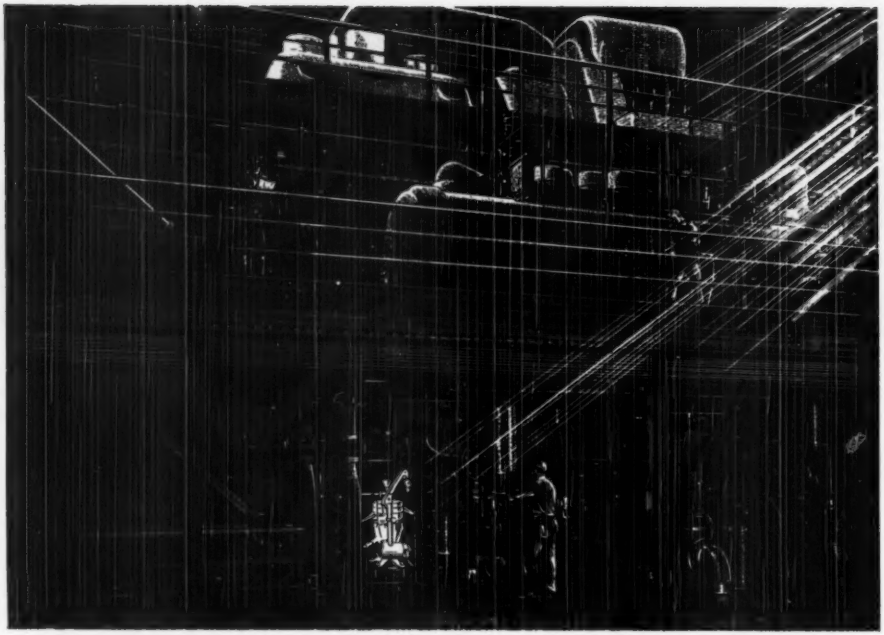
The Complete Powell Line includes Globe, Angle, "Y", Gate, Check, Non-return, Relief, and Flush Bottom Tank Valves in Bronze, Iron, Steel and a wide range of Corrosion-resistant metals and alloys.

Ask your nearest Distributor—or write direct

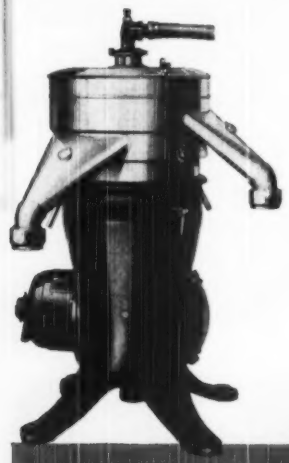
The Wm. Powell Company, Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

VALVES



THIS "DAVID" PROTECTS "GOLIATH!"



The De Laval Oil Purifier is small in size with respect to the great turbine it guards, but its power to ***protect*** is absolute! Removing dirt and liquid impurities from the turbine lubricating oil as fast as they accumulate, these centrifugal machines constantly keep the lubricating oil clean and dry.

The cost of a centrifugal Oil Purifier is so much less than that of even ***one*** serious shutdown that in effect a centrifugal machine is inexpensive ***insurance*** against trouble. Moreover, there is no expensive upkeep cost with a De Laval, for the purifying action is entirely mechanical.

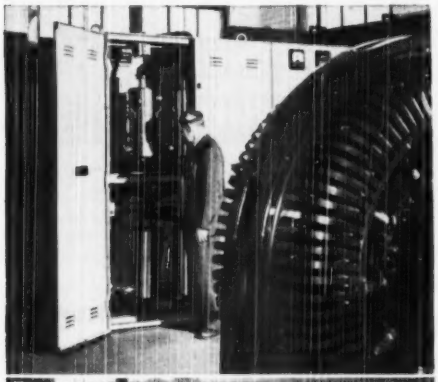
● ***Write for Bulletin TO-1.***

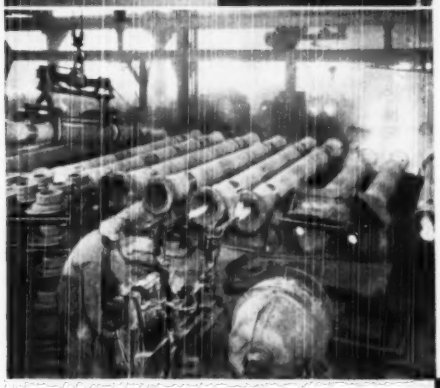
THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL
OIL PURIFIERS
FOR MORE DEPENDABLE POWER PRODUCTION

$30,000 back in 5 years

The 500-kw, 250-volt G-E rectifier at the Florence Pipe Foundry and Machine Company requires only periodic inspection.





The G-E rectifier provides the d-c power which operates the cranes, ladles, and centrifugal casting machinery in the Florence Company's plant.

Florence Pipe Foundry & Machine Company

GETS LOW-COST D-C POWER WITH G-E RECTIFIERS

When the Florence Pipe Foundry & Machine Company needed additional d-c power in 1946, George E. Pfeffer, electrical engineer, looked for the best way to do the job. He learned that installing G-E rectifiers would save in three ways:

1. Installation costs—$10,000 less

The rectifiers were compact enough to fit into the present power house. Other types of generating equipment required the construction of a costly new building.

2. Operating costs—no new personnel needed

Because rectifiers need only periodic inspection, there's no need for standby personnel.

3. Power costs—$600 a year less

The extra high efficiency of G-E sealed rectifiers saves about $600 a year in power bills.

The combined savings will amount to $30,000 in five years. That will pay for the rectifiers, and for the cost of installing them.

To Cut your Power Costs

Find out today how you can put G-E power rectifiers to work in your plant. Call or write your nearest G-E sales office for information. **Apparatus Department, General Electric Company, Schenectady, N. Y.**

G-E MERCURY-ARC RECTIFIERS MEAN LOW-COST D-C POWER

GENERAL ELECTRIC

NONE BETTER FOR HARNESSING HIGH PRESSURE STEAM

CRANE PRESSURE-SEAL BONNET GATES, GLOBES, ANGLES, STOP-CHECKS

(Patented and Patents Pending)

Unlike conventional flanged bolted bonnet design, these Crane valves don't have to fight pressure to hold it. Instead, they actually utilize the forces of pressure to seal the bonnet joint. The higher the pressure, the tighter the seal. Not only does the Crane Pressure-Seal Bonnet principle eliminate bonnet joint sealing problems, it makes possible many outstanding improvements such as the following:

NO BONNET JOINT LEAKAGE—NO BONNET JOINT MAINTENANCE—Because Crane design utilizes line pressure to the maximum degree to make the seal, final pressure tightness at the bonnet joint does not depend on any bolting. This eliminates the need for periodic restressing of the joint.

SAVINGS IN WEIGHT AND SPACE—Up to 60% lighter, in the case of larger size 1500-Pound Gates. Easier to handle. Require less head room. Save on erection and suspension costs.

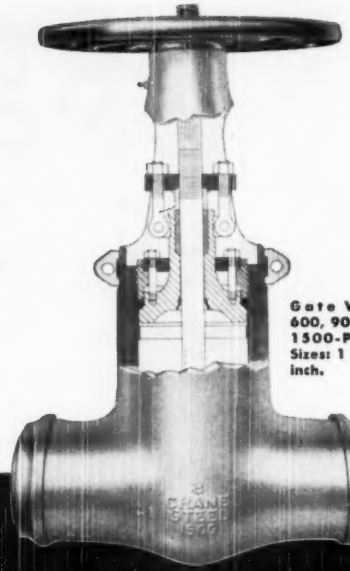
LOW PRESSURE DROP DESIGN—Performance tests prove conclusively that Crane Pressure-Seal Bonnet Valves have superior flow characteristics under all conditions of service.

STREAMLINED BODY—Smooth flowing contours with no abrupt changes in metal thickness minimize stresses caused by pressure, temperature differences, and pipe line strains.

EASY TO INSULATE—Streamlined design simplifies application of insulation and requires less material. Valves can be opened or reassembled without disturbing insulation.

SEND FOR NEW CIRCULAR AD-1819—Illustrates and describes the Crane Pressure-Seal Bonnet principle, and gives all essential data for specifying these valves. Get a copy from your Crane Representative, or **WRITE FOR CIRCULAR AD-1819.**

CRANE Co., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas.



Gate Valve 600, 900, and 1500-Pound. Sizes: 1 to 24-inch.

HOW LINE PRESSURE KEEPS THIS BONNET JOINT PRESSURE-TIGHT

Bonnet joint is inside the valve, sealed with a wedge-shaped seal ring. Internal fluid pressure, acting upon the entire underside of the bonnet, forces the bonnet against the seal ring; this wedges the seal ring between the body and bonnet, forming a pressure-tight metal-to-metal joint.

LIGHTER AND SMALLER

Crane 8-inch 1500-Pound Pressure-Seal Bonnet Gate compared with conventional 8-inch 1500-Pound bolted bonnet gate valve.

Angle Stop-Check 900 and 1500-Pound. Sizes: 6 to 12-inch.

Y-Pattern Globe 900 and 1500-Pound. Sizes: 1 to 4-inch.

EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

You Pay More For HEAT-FAG...

...than for the blower that keeps men cool

When hot, stagnant or fume-filled air distresses your men, your production suffers too.

Give men around furnaces or hot processes, or in confined areas, a steady supply of fresh, cool air with Coppus Blowers and Exhausters and watch their efficiency jump to a more profitable level.

There's a portable, easily adaptable Coppus "Blue Ribbon" product for practically any fresh-air requirement. The Coppus "Blue Ribbon" is the sign of precision workmanship and trouble-free, long-lasting operation. Check and mail the coupon for exact information. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG, BEST'S SAFETY DIRECTORY, MINING CATALOGS.

OTHER COPPUS "BLUE RIBBON" PRODUCTS

HORIZONTAL TURBINE
Six frame sizes —
1 to 150 horsepower

VERTICAL TURBINE
Six frame sizes —
1 to 150 horsepower

FANMIX GAS BURNER

FANMIX OIL BURNER

MAIL THIS COUPON To Coppus Engineering Corp., 166 Park Avenue, Worcester 2, Mass.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets; etc., after treated with coating material.

NAME .....

COMPANY .....

ADDRESS .....

CITY .....

(Write here any special ventilating problem you may have.)

for TROUBLE SPOTS

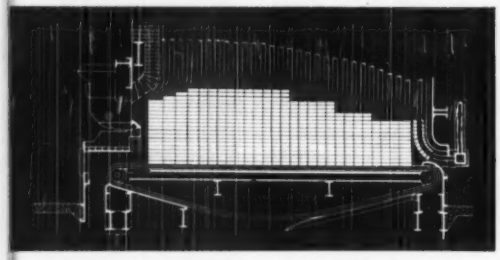
Try Super Refractories

The application of Super Refractories with their unusual properties to certain normally troublesome spots of boiler furnaces means increased refractory life in these areas. This adds up to such profit-producing benefits as increased steaming capacity, fewer outages for repairs, longer setting life, better combustion conditions, and lower production and labor costs.

Of the many Super Refractories offered by CARBORUNDUM, CARBOFRAX silicon carbide and MULLFRAX electric furnace mullite products are the types most often used in boiler furnaces. These materials are supplied as brick, special shapes and cement.

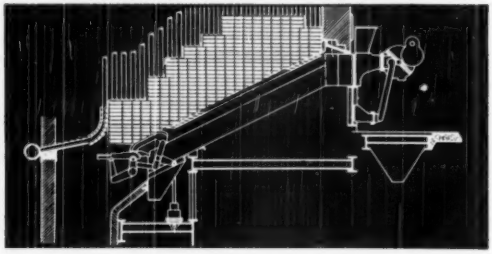
SOME TROUBLE SPOTS WHERE SUPER REFRACTORIES CAN HELP

Spreader Stoker Fired Boiler Furnace — Water Walls



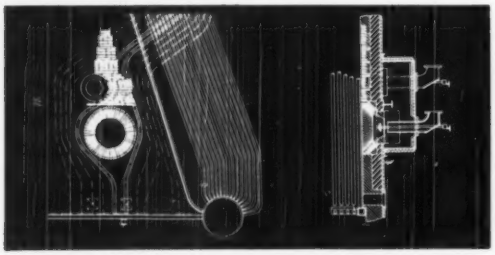
Extended tube life results from use of CARBOFRAX facing blocks. They protect the tubes from abrasive action of the fuel and clinkers on the traveling grate; they protect the tubes from fuel impingement; they prevent slag from forming between the tubes and hampering operations; and they conduct the heat rapidly from the firebox to the tubes.

Multiple Retort Stoker Fired Boiler Furnace



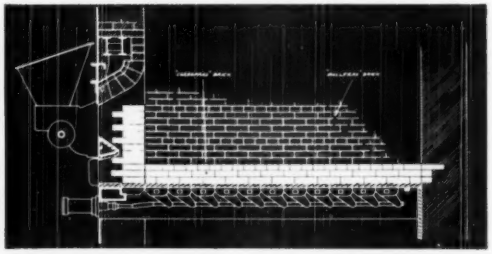
Tight fitting CARBOFRAX facing blocks that do not warp or burn, effectively protect tubes and increase their life. These blocks maintain hot face temperatures and support combustion when fuel or ratings vary markedly.

Lining for Pulverized Coal Burner Ring



CARBOFRAX brick installed in the outer burner ring stoutly resist the extreme erosive, spalling and cracking conditions encountered in this location. Their high refractoriness prevents softening. Retention of burner ring dimensions results in improved combustion. A CARBOFRAX brick facing above the burners also affords added protection against deflecting slag build-up and severe service conditions encountered if the burner becomes tilted.

Spreader Stoker Fired Boiler Furnace — Brick Set



CARBOFRAX brick in the fuel bed zone prevent clinker build-up — help maintain full grate area. They also resist cut-backs caused by flame erosion and mechanical abrasion. CARBOFRAX piers and arches in the front wall withstand the high temperatures, and minimize spalling and cracking. MULLFRAX brick, with their unique resistance to fluid ash, effectively retard erosion of the upper walls. They also remain hard at high temperatures.

in boiler furnaces

by CARBORUNDUM

TRADE MARK

PRODUCT CHARACTERISTICS

REFRACTORINESS	Both CARBOFRAX and MULLFRAX refractories withstand temperatures well above those attained in boiler furnace operation. Since they do not soften, they offer no footing for accumulation of large clinker or slag formations.
HOT STRENGTH	CARBOFRAX brick have an average modulus of rupture of 1600 lbs. per sq. in. at 2462° F. MULLFRAX brick show negligible deformation under a 25 lb. per sq. in. load at 2732° F. Both refractories show no contraction in reheat tests at 2912° F.
THERMAL CONDUCTIVITY	CARBOFRAX refractories have a high thermal conductivity. In uncooled walls, this can be offset by using backing brick with low conductivity. MULLFRAX brick, on the other hand, have heat transfer qualities only slightly above fireclay.
SPALLING RESISTANCE	Both CARBOFRAX and MULLFRAX refractories have unusually high resistance to spalling, showing no loss after many coolings in a special, severe spalling test.
RESISTANCE TO MECHANICAL ABRASION	The close-grained, dense structure of CARBOFRAX brick make them exceptionally resistant to mechanical abrasion and flame erosion. MULLFRAX brick, while not as strong in this respect, are still appreciably more resistant than fireclay.
RESISTANCE TO MOLTEN ASH	MULLFRAX refractories have exceptional resistance to molten ash and to all slags found in boiler furnace operation. CARBOFRAX brick, while not as outstanding in this respect, can withstand ash from low iron content coal. High pyritic sulphur coals, however, usually produce an ash which reacts with CARBOFRAX brick and shapes at high temperatures. This is easily avoided if CARBOFRAX refractories are confined within the fuel bed depth or if the furnace walls are cooled.

"Carborundum," "Carbofrax" and "Mullfrax" are registered trade marks which indicate manufacture by The Carborundum Company

The best utilization of specialized super refractories requires careful study and consideration of both furnace and fuel involved. For this reason, we maintain a specially trained staff of engineers available for consultation. They are at your service at any time, on short notice and without obligation. If you have refractory troubles in any boiler installation, please ask for their help. Through judicious selection and correct application of super refractories they may be able to help you achieve real economies.

Meanwhile you may find our 32-page booklet, "Super Refractories for Boiler Furnaces," of interest and of value. A letter or card will bring you a copy of this useful booklet.

Dept. E-60

THE CARBORUNDUM COMPANY

Refractories Division

PERTH AMBOY • NEW JERSEY

for IDEAS that

Simplify and Improve Design
•
Better Fabrication
•
Reduce the Cost

ASK FOR

MODERN PIPE WELDING PRACTICES

BY F. C. FANTZ

BULLETIN 49-A

MIDWEST PIPING & SUPPLY CO., INC.
ST. LOUIS – NEW YORK – BOSTON – LOS ANGELES – CHICAGO

of Piping Systems

This technical bulletin is a study of ways and means of using welding for the improvement of piping systems. It was written by F. C. Fantz, Vice President, Midwest Piping and Supply Co., Inc., out of many years' experience with welding as applied to all kinds of piping. He has described in detail and illustrated a number of practical, tested methods of obtaining better piping assemblies. Here is a 16-page bulletin full of workable, proven ideas that will be helpful to anyone interested in modern piping systems. Use the coupon below or ask the nearest Midwest plant or office for a copy.

Midwest Piping & Supply Co., Inc.
1450 So. Second St., St. Louis 4, Mo.

Please send me (without obligation) Bulletin 49-A, "Modern Pipe Welding Practices."

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

MIDWEST PIPING & SUPPLY CO., Inc.

MAIN OFFICE: 1450 SOUTH SECOND STREET, ST. LOUIS 4, MO. Plants: St. Louis, Passaic, Los Angeles and Boston • Sales Offices: New York 7—30 Church St. • Chicago 3—79 W. Monroe St. • Los Angeles 33—520 Anderson St. • Houston 2—1213 Capitol Ave. • Tulsa 3—533 Mayo Bldg. • Boston 27—426 First St.

4079

PIPE SCALE
CAUSED BY
IMPURE STEAM

DEARBORN
ANTI-FOAM
KEPT THIS PIPE
FREE FROM SCALE

DEARBORN POLYAMIDE ANTI-FOAMS REDUCE FOAMING, KEEP VITAL STEAM LINES CLEAN

These are unretouched photographs of cutaway sections of superheater tubes. The bend at the left has a heavy scale deposit—the result of incompletely treated boiler water. The bend at the right was kept free from scale because the boiler water was treated with Dearborn Polyamide Anti-Foam 659.

This recent Dearborn development reduces foaming . . . prevents carry-over and consequent deposits of scale which may foul superheater tubes, turbine blades, valves and cylinders . . . conditions sludge . . . is compatible with other boiler water treatment.

If you use steam—in the operation of your plant or in the manufacture of your product—it will be worth your while to investigate Dearborn Polyamide Anti-Foam and other Dearborn water treatment service. The broad experience of Dearborn . . . gained by serving industry since 1887 . . . is immediately available to you.

DEARBORN CHEMICAL COMPANY
General Offices: 310 South Michigan Avenue • Chicago 4, Illinois

WRITE FOR COPIES OF THESE TWO VALUABLE BOOKLETS

For full information on Dearborn Polyamide Anti-Foams, write for Bulletin No. 5008. And for the story of Dearborn Industrial Water Treatment and Engineering Service, write for Bulletin No. 5000. The coupon is for your convenience.

DEARBORN CHEMICAL COMPANY
Dept. PO, 310 S. Michigan Ave., Chicago 4, Ill.
Gentlemen: Please send:
☐ Bulletin No. 5008—Dearborn Polyamide Anti-Foams
☐ Bulletin No. 5000—Dearborn Industrial Water Treatment and Engineering Service.

Name.....
Company.....
Position.....
Address.....
City.....*State*.....

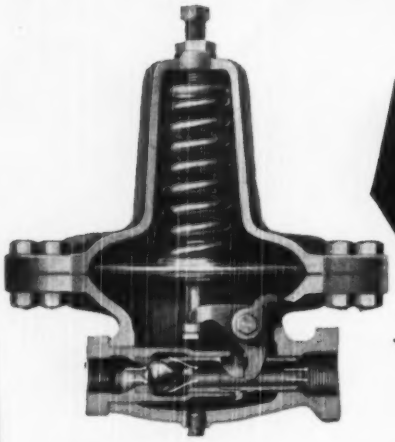
Dearborn
TRADE MARK REGISTERED
THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES

10 POINT *Results*

FROM

CASH STANDARD *Streamlined* PRESSURE **REDUCING VALVES** TYPE 1000

THESE TROUBLEMAKERS FIND NO OPPORTUNITY TO PERFORM WITH THE "1000" ON THE JOB



A MANUFACTURER CHECKS THE 10 POINTS AND SAYS . . .

"We have 3 of these '1000' valves and all of them are giving good service."

THE 10 POINTS ARE CHECKED BY A RESEARCH FOUNDATION, THEY SAY

"These valves have been VERY SATISFACTORY BOTH IN OPERATION and MAINTENANCE. The MAINTENANCE COST IS ABSOLUTELY NOTHING once this '1000' valve is installed. Wherever any one may need CONTROLLED PRESSURE IN EITHER STEAM, AIR, or ANYTHING—this CASH STANDARD '1000' valve can be relied upon to do just that and TO GIVE CONTINUED TROUBLE-FREE service."

A MEAT PACKER SAYS IN CHECKING THE 10 POINTS . . .

"Very little maintenance required."

A STEEL CASTING CO. CHECKS THE 10 POINTS—THEY SAY . . .

"We find your CASH STANDARD Streamlined Type '1000' Pressure Reducing Valves to be VERY RELIABLE. We have a number of these valves in service throughout our plant, and have NEVER HAD ONE OUT OF SERVICE for any reason. These '1000' valves have been in service for approximately five years."

A MOULDED PRODUCTS CO. CHECKS THE 10 POINTS AND SAYS

"Maintenance time and cost very low."

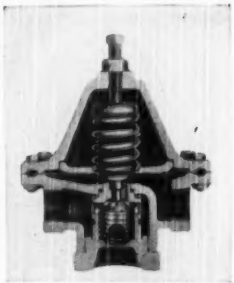
These are the Points
USERS CHECK WITH . . .

1. **Maximum capacity when needed most.**
2. **Accurate pressure control under toughest working conditions.**
3. **Trouble-free service.**
4. **Smooth operation.**
5. **Tight closure.**
6. **Speedier production results.**
7. **Elimination of failures.**
8. **Cost-saving operation.**
9. **No spoilage.**
10. **Practically zero in maintenance.**

WRITE FOR BULLETIN 962

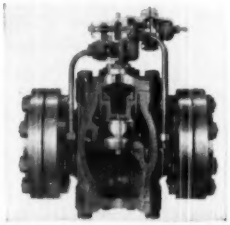
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.

Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

You can be sure when a **B&W Refractories Engineer** *recommends boiler refractories*

If you are having trouble with boiler furnace linings . . . if they are causing high maintenance costs and excessive outages . . . consult your B&W Refractories representative. He understands your problems . . . knows their solutions . . . And he can make expert recommendations from B&W's *complete* line of refractories:

HEAVY FIREBRICK

For furnaces with slagging, flame impingement and spalling conditions, either B&W 80 or Junior Firebrick can be used. 80's assure uninterrupted service at extremely high ratings. Juniors are recommended where load bearing and temperature requirements are less severe, but too severe for the best grades of fireclay brick.

INSULATING FIREBRICK

B&W Insulating Firebrick have the lightest weight and lowest heat conductivity of any insulating firebrick in their class. They store and conduct less heat—withstand direct exposure to furnace gases. Available in six types for temperatures from 1600 F to 2900 F.

PLASTICS

Used widely for repairs and for forming special shapes *in place*, B&W *Plastic Moldable* and *B&W Plastic Chrome Ore* offer long life under severe conditions. Plastic Moldable is suitable for use in the great majority of furnaces. It withstands temperatures up to 3000 F. Plastic Chrome Ore is ideally suited for severe slagging conditions.

CASTABLES

In furnaces that require the high resistance of chrome to chemical attack and where speed of installation is important, B&W offers *Kromecast* for temperatures up to 3100 F and *Hydrochrome* for temperatures up to 2800 F.

For burner openings, door linings, walls, roofs and arches, B&W *Kaocast* possesses unusual volume stability and resists spalling. It easily withstands temperatures up to 3000 F.

B&W Baffle Mixes are excellent castables for the construction of monolithic boiler baffles, door linings and other general uses. They are smooth and flow easily, have high strength in small sections. Widely used to withstand temperatures as high as 2600 F.

B&W Insulating Concrete Mixes combine refractoriness, light weight and low heat conductivity with the ability to be poured like ordinary concrete. For temperatures up to 2200 F.

MORTARS

B&W Mortars—Selecting the right mortar is vitally important to long refractory life. B&W Mortars pay for themselves by saving time in application and by satisfactorily performing their jobs under the designed furnace conditions.

For help with a furnace maintenance plan to cut costs and prevent unscheduled outages, call your local B & W Refractories Engineer.

R-371

B&W

B&W REFRACTORIES PRODUCTS

B&W 80 FIREBRICK • B&W JUNIOR FIREBRICK
B&W 80 GLASS TANK BLOCKS • B&W INSULATING FIREBRICK
B&W REFRACTORY CASTABLES, PLASTICS AND MORTARS

•

OTHER B&W PRODUCTS

Stationary & Marine Boilers and Component Equipment
Chemical Recovery Units . . . Seamless & Welded Tubes . . . Pulverizers
Fuel Burning Equipment . . . Pressure Vessels . . . Alloy Castings

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
GENERAL OFFICES: 85 LIBERTY ST., NEW YORK 6, N.Y.
WORKS: AUGUSTA, GA.

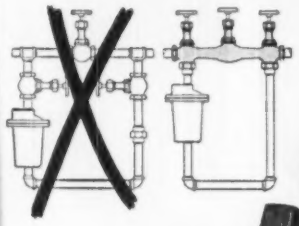
In power or process piping, you'll

SAVE

money
space
maintenance
weight
time

WITH THE

HONEYWELL BYPASS



Outmoded set-up at left uses 18 threaded joints . . . Honeywell Bypass uses only eight.

THE Honeywell Bypass is a completely assembled and ready-to-use unit . . . compact and convenient. It eliminates from eight to fourteen threaded joints . . . with the usual leakage and maintenance . . . and affords continuous, trouble-free operation.

Yet it costs no more than the assortment of valves, nipples, fittings, unions and pipes (plus the cutting, threading and assembling) that you may be using now. The Honeywell Bypass is available in Bronze, Iron and Steel . . . for pressures up to 300 lbs. . . . with screwed or flanged ends.

Call in your local Honeywell engineer for detailed information on this bypass and such other Honeywell products as: Hi-Lift Hand Control Valves, Transfer Valves, Low Lift Diaphragm Control Valves, Liquid Level Devices and Steam-Jacketed Rotary Cocks.

COMMERCIAL · RESIDENTIAL · INDUSTRIAL
WORLD'S LARGEST ORGANIZATION FOR ADVANCED INSTRUMENTATION AND CONTROL

Write, today, for a copy of Bulletin #254-1

MINNEAPOLIS-HONEYWELL REGULATOR CO.
INDUSTRIAL DIVISION
1900 Windrim Avenue
Philadelphia 44, Pa.
Offices in 77 principal cities of the United States, Canada and throughout the world

MINNEAPOLIS
Honeywell
VALVE PRODUCTS

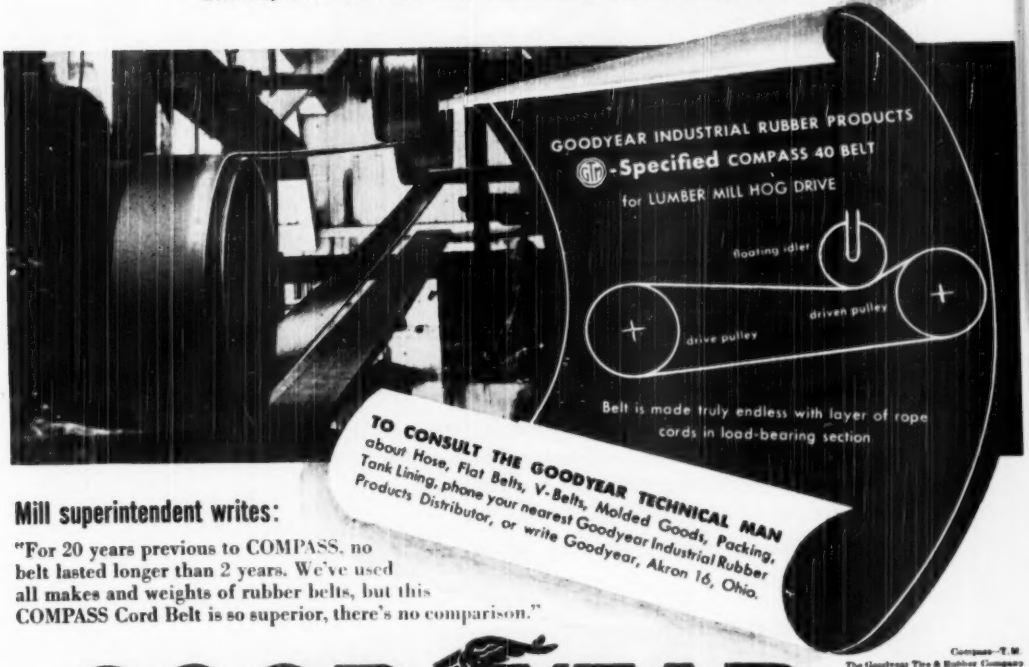
California Lumber Mill reports

8 times longer service

with COMPASS Belt on Hog Drive

Best Previous Belt Service — 2 years

G.T.M.-Specified COMPASS 40 Belt — 16 YEARS AND STILL RUNNING!


GOODYEAR INDUSTRIAL RUBBER PRODUCTS
-Specified COMPASS 40 BELT
for LUMBER MILL HOG DRIVE
floating idler
driven pulley
drive pulley
Belt is made truly endless with layer of rope cords in load-bearing section

TO CONSULT THE GOODYEAR TECHNICAL MAN about Hose, Flat Belts, V-Belts, Molded Goods, Packing, Tank Lining, phone your nearest Goodyear Industrial Rubber Products Distributor, or write Goodyear, Akron 16, Ohio.

Mill superintendent writes:

"For 20 years previous to COMPASS, no belt lasted longer than 2 years. We've used all makes and weights of rubber belts, but this COMPASS Cord Belt is so superior, there's no comparison."

Compass—T.M. The Goodyear Tire & Rubber Company

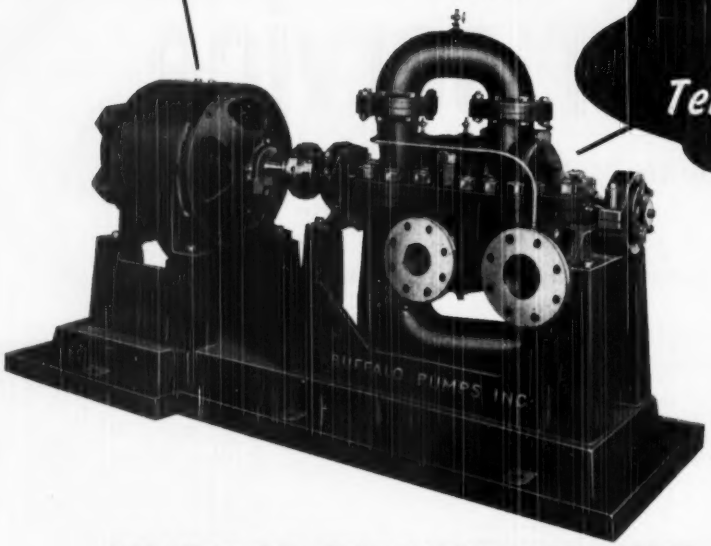
GOODYEAR

THE GREATEST NAME IN RUBBER

For Pressures up to 1500 Ft.

For Clear Water Service

Efficient at any Temperature



"Buffalo"

"RR"

PUMPS

READY TO CUT YOUR PUMPING COSTS

If you have a clear-water pumping application calling for a high head and capacity between 20 to 900 gpm., you'll get satisfaction with an "RR". These "Buffalo" Single Suction Two and Four Stage Pumps have set both efficiency and endurance records on the job — in boiler feed and other general service. Thousands in use all over the country. WRITE FOR BULLETIN 980-B for the facts on these pumps users say you can "put in and forget".

—for handling clear water at high pressures, any temperature
"Buffalo"
Class RR Single Suction Multistage Pumps
BUFFALO PUMPS INC

BUFFALO PUMPS, INC.

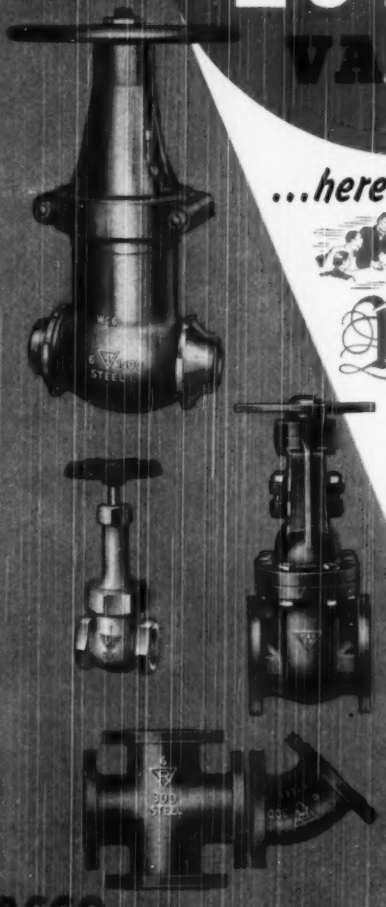
488 BROADWAY BUFFALO, N. Y.

Canada Pumps Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities

more and better service from

R·P&C VALVES



...here's One Reason Why:

Over 60 years ago, a PRATT & CADY Board of Directors passed this resolution:

Resolved:

"That the superintendent
"shall be held responsible
"for the production of goods
"as near perfect in design,
"material and workmanship
"as shall make them merchantable
"and of a character that will serve
"to establish for this company
"a high reputation."

•This policy has remained unshaken through two world wars. The "high reputation" has been maintained. More than ever before, the valves offered by R·P&C meet the demand for longer and better service.

ACCO

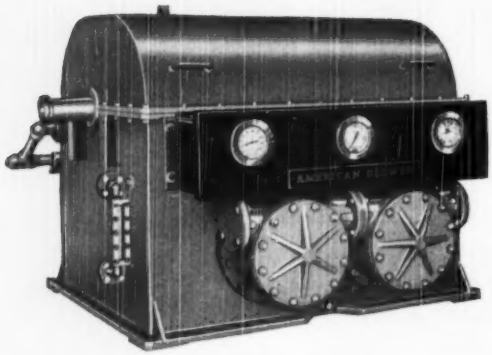
Reading, Pa. • Atlanta • Baltimore • Boston • Chicago • Denver • Detroit • Houston
New York • Philadelphia • Pittsburgh • San Francisco • Bridgeport, Conn.

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

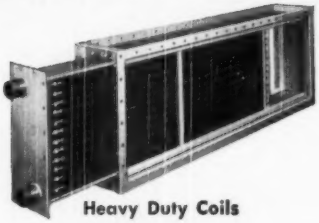
TRADE MARK

READING-PRATT & CADY VALVES

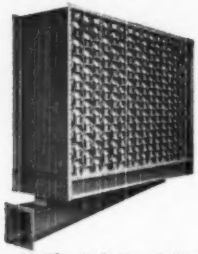
Save power, prolong equipment life with...
GÝROL FLUID DRIVES FOR BOILER FEED PUMPS



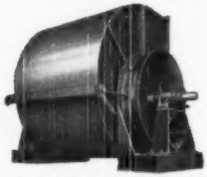
Type VS, Class 6 Gýrol Fluid Drive for Boiler Feed Pumps



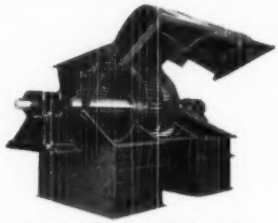
Heavy Duty Coils



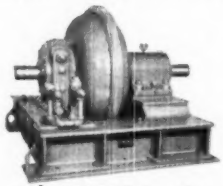
Type ST Fly Ash Precipitators



American HS Forced Draft Fans



Sirocco Induced Draft Fans



Gýrol Fluid Drives for Mechanical Draft Fans

American Blower Type VS, Class 6 Gýrol Fluid Drive is designed specially for the heavy duty required of high-speed (3600 RPM) boiler feed pump drives.

It offers these important advantages to power plant operators:

1 **Power Savings**—the adjustable speed feature of Gýrol Fluid Drive offers a substantial saving in power.

2 **Flexibility of Control**—the narrow range of speed over which a boiler feed pump must operate (15 to 25% of motor speed) requires a quick, easy control, capable of fine increments of speed adjustment. The infinitely adjustable speed control of Gýrol Fluid Drive, together with its rapid response, meets this specification.

3 **Lower Pressures**—in many high-pressure boiler installations, reduction in pressure from adjustable speed operation amounts to 500 lbs. and more, at reduced flows. This pressure reduction considerably lowers the duty on piping, high-pressure heaters and valves.

4 **Reduced Maintenance**—it follows that adjustable speed reduces wear on pumps and the large pressure reduction from adjustable speed operation prolongs the life of equipment and reduces maintenance.

American Blower Gýrol Fluid Drives for boiler feed pumps are already being used by many of America's newest and finest public utilities.

For the complete, concise, factual data on Gýrol Fluid Drives for boiler feed pumps, write for our Bulletin 8019. And if you'd like data on American Blower Mechanical Draft Fans, Fly Ash Precipitators, Heavy Duty Coils and Gýrol Fluid Drive for fan control—write, stating your requirements, or phone our nearest branch office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

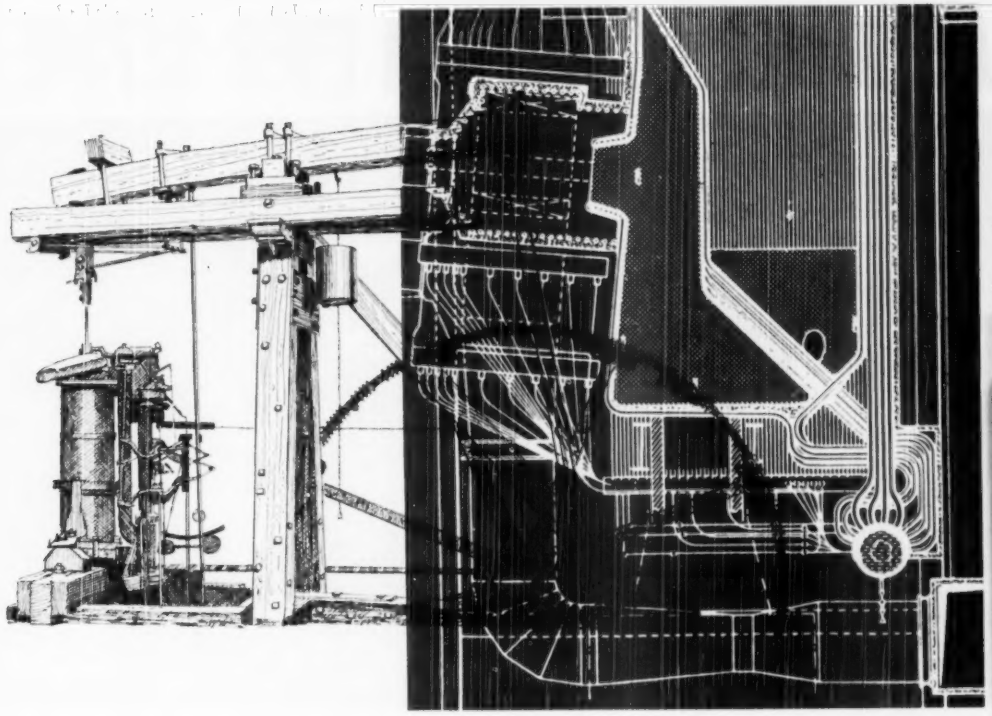
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

YOUR BEST BUY AMERICAN BLOWER POWER PLANT EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

Watt would be horrified!



The condensing steam engine of James Watt made modern industry possible. Until he died in 1819, however, Watt argued stoutly that steam should be used only at a few pounds above atmospheric pressure. What would he think of central stations generating steam at pressures up to 2500 psi—or even of industrial power plants using today's "low" pressure of 400 psi?

Watt never thought of worrying about the water converted into steam for his engine. Today, high pressure, high temperature, and high rating make the conditioning of boiler water a complex problem in chemical engineering. In one plant, precision control of phosphate and silica at levels of only a few ppm may be the most economical way of simultaneously keeping sludge off tube surfaces and silica off turbine blades. In another, better clarification of raw water may be the most practical line of attack on a tough problem of complex silicate scale.

Hall Laboratories is equipped, through years of experience and continuing research, to deal with the almost infinite variety of cross-relationships presented by modern boilers—and also to advise on all other industrial water conditioning problems. A copy of the new Hall Bulletin "Your Most Important Raw Material" is yours for the asking.

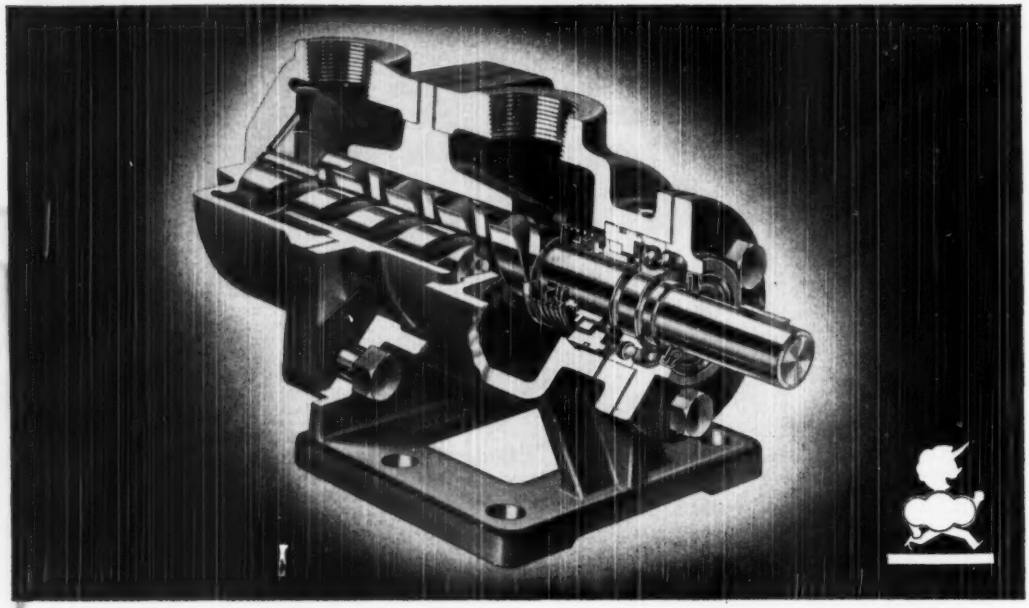
Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pennsylvania.

HALL *plant-wide* WATER SERVICE

BOILER WATER CONDITIONING

PROCUREMENT, TREATMENT, USAGE AND DISPOSAL OF INDUSTRIAL WATER

A NEW IMO PUMP
AT LOWER COST THAN EVER BEFORE!



ONLY AN IMO GIVES YOU THESE ADVANTAGES

RELIABILITY — only three moving parts — no gears, vanes, pistons. Nothing to get out of order or adjust. The mechanical packing seals never require attention.

QUIETNESS — no noise, no vibration.

FREEDOM FROM PULSATION — continuous, axial flow.

HIGH SPEED OPERATION — for direct connection to motors, turbines, and machines. Also can be driven by belt or chain.

LOWER COST THAN EVER BEFORE

The new IMO A313A possesses all the unique advantages of the IMO pumping principle — it is built to the highest quality standards but it is designed especially to permit low cost, standardized quantity production.

The IMO A313A can be used for delivering up to 80 gpm against pressures to 150 psi, as required for lubrication service, oil transfer, low pressure, hydraulic systems, and general pumping of oil and viscous fluids.

Send for Catalog I-159-P

DE LAVAL

IMO-DE LAVAL PRODUCTS DIVISION

DE LAVAL STEAM TURBINE CO. • TRENTON 2, N. J.

I-159

POWER

CROSS-INDEX OF SUBJECTS FOR THE MONTH

JUNE 1950 • VOL 94 • NO. 6

P W SWAIN *Editor*
L N ROWLEY *Executive Editor*
F A ANNETT *Associate Editor*
J C McCABE *Associate Editor*
B G A SKROTZKI *Associate Editor*
J J O'CONNOR *Assistant Editor*
C F SANDERS *Assistant Editor*
C F MARSCHALEK *Art Editor*
SHELTON FISHER *Publisher*
W J HARING *Sales Manager*

Washington: GEORGE B BRYANT JR *Atlanta:* EARLE MAULDIN
WORLD NEWS OFFICES: *London, Paris, Frankfurt, Tokyo, Melbourne, Rio de Janeiro, Mexico City*

PLANT OPERATING METHODS, MAINTENANCE AND SAFETY
STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

SPECIAL SECTION

REFRACTORIES — a practical handbook ... 73
What refractories do ... 74
Properties of refractories ... 76
How refractories behave ... 78
Refractory applications ... 82

FEATURE ARTICLES

Do you run your diesel plant by ear? ... 89
Rapid test for calcium hardness ... 92
Welding loads need good power supply ... 94
You can predict air-conditioning results by graphs ... 97
Pumping plant boasts siphon intakes ... 100
Motor selection for power-plant auxiliaries ... 102
It's a power show on wheels ... 105
Letters from a turbine specialist ... 109
Supervisory control system teams elevators to traffic use ... 110
Pneumatic flyash-handling systems ... 113
Getting the most from insulation-resistance measurements ... 116
Know your loads when buying power equipment ... 118
Speaking of Power ... 121

DEPARTMENTS

Electronics ... 122
What's your answer? ... 124
Power engineer's notebook ... 126
Plant problems ... 130
Technical briefs ... 134
Power news ... 140
Data sheet ... 144
Plant equipment news ... 146
George Edwards ... 154
Readers' service page ... 194a

VOLUME 94, NUMBER 6 • ABC • ABP • COPYRIGHT 1950 by McGRAW-HILL PUBLISHING CO., INC. • ALL RIGHTS RESERVED

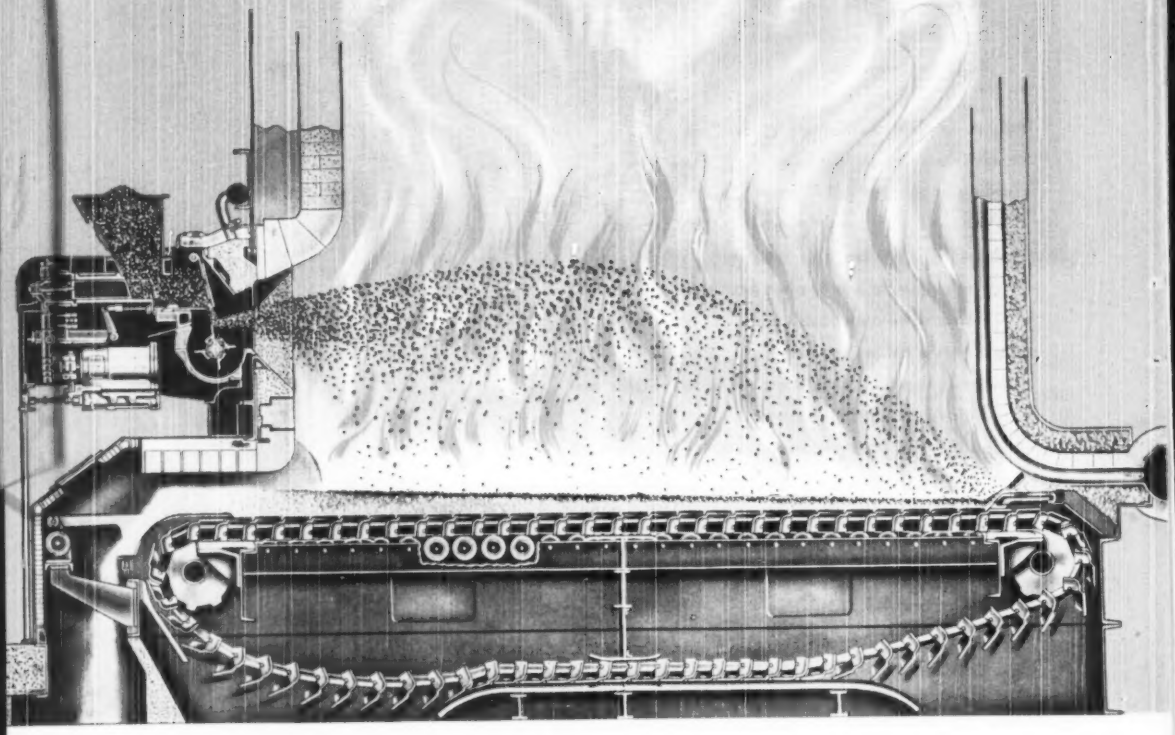
James H McGraw (1860-1948), Founder; Curtis W. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A Gerardi, Secretary and Treasurer; Paul Montgomery, Senior Vice-President, Publications Division; Nelson Bond, Vice-President and Director of Advertising; J E Blackburn Jr, Vice-President and Director of Circulation • DISTRICT MANAGERS: New York, W W Querles; Philadelphia, C R Long; Cleveland, N O Wynkoop Jr; Chicago, C Boughton, J L King; Boston, J E Slater; St. Louis, C Boughton • PUBLICATION OFFICE: 418 West 25th St, New York 1, N. Y. • EDITORIAL AND EXECUTIVE OFFICE, 330 W 42nd St, New York 18 N Y • Cable Address: "McGraw-Hill New York • DISTRICT OFFICES: 520 N. Michigan Ave., CHICAGO 11; 8 Post St, San Francisco; National Press Bldg, Washington 4; Architects Bldg, Philadelphia 3; 738-9 Oliver Bldg, Pittsburgh 22; 1510 Hanna Bldg, Cleveland 15; 2980 Peaobscot Bldg, Detroit 26; Continental Bldg, St. Louis 8; 1427 Statler Bldg, Boston 16; 1011 Rhodes-Haverty Bldg, Atlanta 3; 1111 Wilshire Blvd, Los Angeles 17; First National Bank Bldg, Dallas 1; Aldwych House, Aldwych London WC2 • POWER articles are indexed in both the Industrial Arts and the Engineering Index • POWER issues its own index annually; copies are available on request to the editorial offices, 330 W 42nd St, New York 18.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

CENTRAFIRE

with *Traveling Grate*



Westinghouse

STOKERS

. . . . . brings Extra Engineering Refinements To Spreader-Type Firing

The outstanding performance of the Centrafire with Traveling Grate stems from features that are built in—not added as accessories.

A positive; metered flow of coal, wet or dry, is fed continuously by an air-cooled overthrow rotor into the combustion area. Proper distribution is effected automatically by cyclic control of the rotor speed.

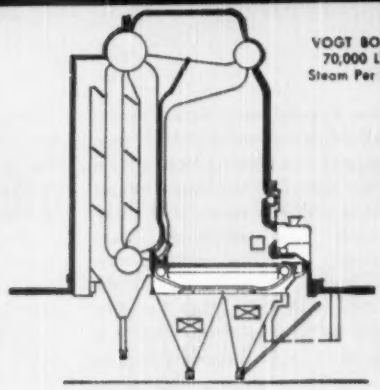
All moving elements are hydraulically operated by one turbine or motor-driven oil pump. This assures infinite flexibility through the complete range of operation—synchronizes coal feed and grate speed.

Grates are plate-type, laboratory tested under conditions far more severe than those of actual service. Rollers support the grate chains, reducing friction and power requirements.

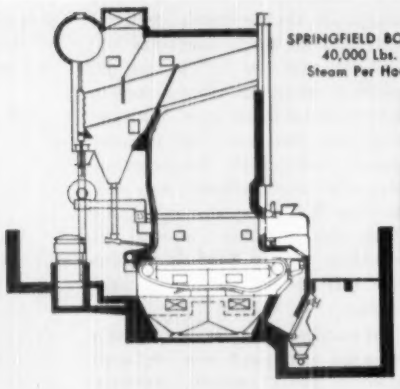
Fuel distribution adjusted automatically to air flow through front and rear grate sections results in intimate mixing of fuel and air for thorough combustion.

The Centrafire's range extends upward of 300,000 lbs. of steam per hour. Its adaptability to deep, narrow furnaces permits use of the most economical boilers.

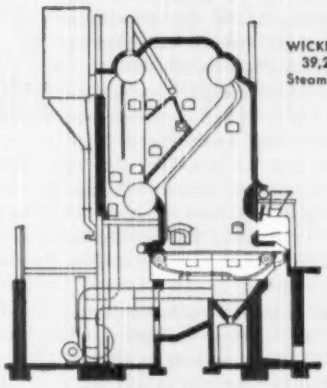
It will pay you to get the full Centrafire story. Ask your Westinghouse representative for complete data, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-30504



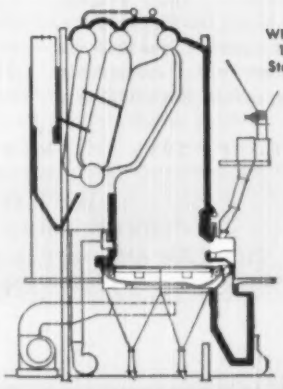
VOGT BOILER
70,000 Lbs.
Steam Per Hour



SPRINGFIELD BOILER
40,000 Lbs.
Steam Per Hour



WICKES BOILER
39,200 Lbs.
Steam Per Hour



WICKES BOILER
110,000 Lbs.
Steam Per Hour

When the old stack failed at the Pittsfield, Mass., plant of A. H. Rice Company, the owners looked for a replacement that would give longer service with less repair and maintenance. They settled on Byers Wrought Iron. The towering new stack shown in the illustration was erected by William Allen Sons Co.

The soundness of this choice is confirmed by the reported experience of many engineering users. One company, for instance, had a composite stack—bottom wrought iron, and the top 30-ft. section low-first-cost material. In the first 28 years of operation, the top section was replaced three times. Wrought iron was then used for replacement, and—with the original wrought iron bottom—was still serving 20 years later when the stack was no longer needed. Its condition was so good that it was sold and re-used by an industrial school.

In another instance, the top of a wrought iron stack was replaced after 30 years' service. Low-first-cost material was used. After only *five* years under the conditions that wrought iron has withstood for 30, this new top section failed.

With today's high maintenance costs, it is just plain good business to assure that every metal stack lasts as long as possible, with as little attention as possible. The importance of this move increases as stacks grow taller, for the higher the stack—the higher the cost of maintenance.

Some degree of corrosion is encountered in every unlined metal stack. The CO_2 present in all flue gases, when dissolved in any condensed moisture, forms a dilute acid that is highly destructive to vulnerable materials. Most fuels also contain some sulfur compounds, which aggravate the condition. Changes in fuels, intermittent operation, or stack heights that permit the cooling of the gases below the dew point, may increase the severity of attack at any time.

Wrought iron has a unique structure that arms it against this threat. The tiny fibers of glass-like silicate slag that are threaded through the body of high-purity iron are immune to corrosion, and halt and disperse any attack. This discourages the pitting and rapid penetration that causes ordinary materials to fail. The fibers also anchor the initial protective film, which shields the underlying metal.

Repairs come high in stacks like this... so they replaced with BYERS WROUGHT IRON

You will find some helpful information on the general problem, and some facts on successful solutions, in our bulletin WROUGHT IRON FOR FLUE GAS CONDUCTORS AND COAL HANDLING EQUIPMENT. We will be very glad to send you a copy, on request.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, San Francisco. Export Division: New York, N. Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

POWER.....Reports on...

REFRACTORIES

By B G A SKROTZKI, *Associate Editor*

Here's your practical handbook on refractory materials and shapes: what they do, p 74 • their properties, p 76 • how they behave, p 78 • laying brick, p 80 • applications, p 82

A lump of coal, a firebrick. Not much to look at, are they? But think a moment. Without fuels to yield heat, where would we be? How would we warm our homes, smelt our ores, make our power? And what good would heat be without refractory materials to confine and control it? There in the lump and the brick we have the humble symbols of a partnership on which rests modern industrial civilization.

To power engineers particularly, that familiar brick is important. We, as much as any of our engineer fellows, owe a debt to the artisans of ancient races who learned to mold bricks from clay; to their descendants who discovered that "burning" made better brick.

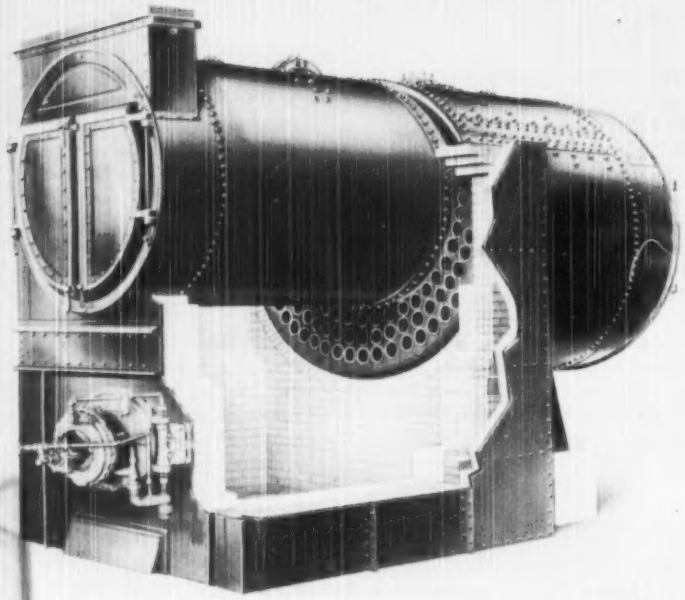
And, perhaps without knowing it, we owe a debt to the alchemists of medieval times who first used clay as a refractory material. With it they lined the crucibles in which they vainly sought to transmute the base elements into gold.

For these were the beginnings of the modern refractories industry. Its actual birthplace was 18th century England, where so much of our modern technology got its start. There, for the first time, special "fire" clays were processed by common brick-making methods. And an essential material was ready for the coming age of steel and steam.

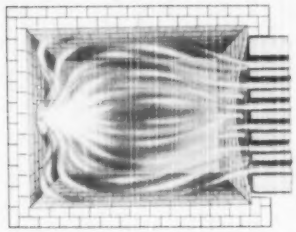
In those early days of the steam-making art, demands on refractories were modest. But as engineers learned more about firing and heat absorption, they strove for ever greater furnace heat release. Then the going got tougher for the refractories. Similar advances were being made in steel making and in the new chemical and petroleum industries. Better refractories were needed; research produced them.

Today we have many refractory materials, available in many forms. Each has its special qualities and its particular place of usefulness. If we power engineers are to apply them with maximum effectiveness, we must know our way about in this field, no longer a simple one.

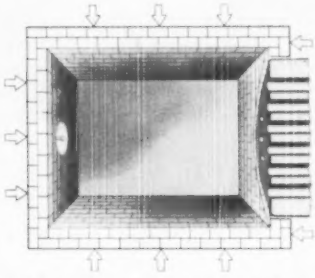
This special section, POWER's 76th, aims to serve as a guidebook for such exploration. In it you will find: (1) a brief review of the jobs refractories do in boiler furnaces, the forms in which they are available and how they are made, (2) condensed information on the properties of refractory materials and how they are affected by service conditions, (3) practical pointers on building refractory structures, and (4) a summary of the ways refractories are applied in modern boilers and steam generators. Use it as your guide to longer refractory life, better service and lower maintenance.



1 Oil-fired furnace setting illustrates a relatively simple but typical application. Steel structure carries boiler weight; the refractory setting never does



2 Furnace confines combustion process, directs the gas over boiler surfaces



5 Settings must be tight to in-leakage of air as well as out-leakage of gas

What Refractories Do

Knowing something about the job refractories must do in modern boiler furnaces, also how their various properties fit them for it, is important to both designers and operators. To designers, because they select and direct the placing of refractories. To operators, because knowing abilities and limitations of refractory materials makes it possible to avoid abusing them.

Well, just what do we expect refractories to do? The answers shape up about as follows. They must:

1. Confine the combustion process and its products
2. Control and direct heat flow
3. Prevent unwanted air entering furnace and gas passages
4. Resist destructive erosion and corrosive action of combustion
5. Have adequate strength and stability to resist forces met
6. Have enough flexibility to accommodate wide temperature changes

Let's look at these answers a little more closely. For good combustion we must bring fuel and air together in the right proportions, and at the right temperature. Then we must see that resulting gases keep on mixing with air so they burn completely. Finally, we must direct combustion products into and through the boiler heating surfaces to squeeze the most heat out of them. This is hot work. The container we do it in — the boiler setting — has to be made of heat-resisting materials. Refractories, in other words.

Heat Control. The furnace does the toughest part of the job in handling the fire. Modern furnaces usually contain a high percentage of heat-absorbing surface (waterwalls, for example). Yet temperatures run high. Though the refractory itself heats up tremendously, it must minimize heat flow through itself to areas surrounding the boiler. In most furnaces, exposed refractory surfaces are located to reflect heat back in the fire zone to maintain ignition. Thus a big part of the setting's job is controlling and directing heat flow.

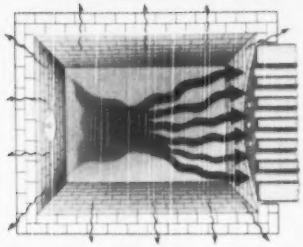
Ordinarily, we think of a container as keeping things *in*. A boiler setting must work both ways. We don't want heat and combustion products leaking out. Neither do we want air leaking into the furnace, which usually operates at a pressure slightly under atmospheric. Such unwanted air only adds to the heat loss from the stack.

Qualities Needed. To do these several jobs satisfactorily, refractory materials and the structures built of them must have qualities beyond the obvious one — ability to withstand high temperature. In addition to the effects of heat alone, for example, refractories must resist erosion of solid particles carried in the combustion gas. Incompletely burned hydrocarbons and CO tend to set up reducing actions on the surface. Slag may wash and break away wall surfaces. Abrading action of clinkers along the sides of stokers must be resisted. So we see that withstanding heat is only one virtue of several demanded.

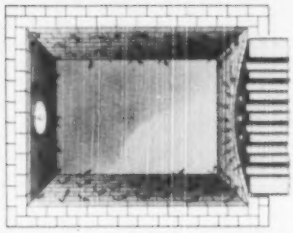
Refractory walls must have strength and stability to carry their own weight and to withstand occasional furnace puffs and vibrations. These factors depend mostly on design and construction, which must take into account mechanical abilities and limitations of refractory materials.

Handling Expansion. Starting and

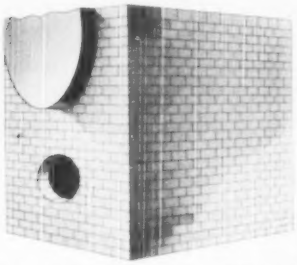
PERFORMS SEVERAL FUNCTIONS AT ONE TIME



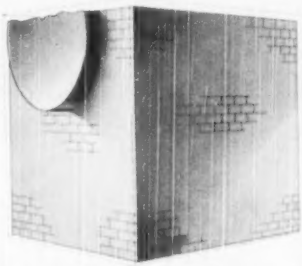
3 Refractory minimizes heat loss to atmosphere, helps heat flow to boiler



4 Refractory must resist wearing action of solids and slag as well as of heat



6 Settings must possess stability and strength to resist upsetting forces



7 Construction must allow furnace walls to both expand and contract as needed

stopping a boiler takes the setting through wide temperature changes. Like most materials, refractories change in dimensions when temperature varies. With the temperature range met in furnaces, these movements become quite large. Design and construction must take careful account of this behavior. Not allowing enough for expansion invites wall failure from buckling. And the necessary expansion joints add to the problem of tightness.

MAKING REFRACTORIES

Where do these refractories come from and how are they made? With few exceptions, commercial refractories are oxides or combinations of oxides (see table, p 77). These occur naturally as clays, rock of various kinds, and as ores. There are also some synthetic refractories.

While manufacturing processes vary depending on type of material, the main steps of all are similar. First comes *preparation* of raw material — grinding, screening, mixing, etc. This is followed by a *forming* operation. Finally the brick or shape is *hardened* by drying and burning or firing. There are three commonly used forming methods: (1) *Hand molding* today is confined largely to large, intricate and special shapes. (2) In the *stiffmud* process, plastic refractory material is extruded through a die. From the column so produced, blanks are cut, then sized, pressed and branded. (3) Most refractory brick is produced by *power-press molding*. Mechanical presses at high pressure compress a damp mix to brick form, automatically.

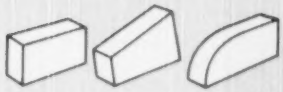
Available Shapes. Manufacturers' catalogs show hundreds of standard shapes and sizes of refractories. These include, in addition to bricks of various proportions: wedges, jambs, keys, skews, arches, tiles, etc. Special shapes can be made in almost unlimited variety. Consult maker before ordering, so design minimizes cost.

Refractories are also applied in *plastic* form, sometimes called a *ramming mix*. Material is put in place and pounded into shape with heavy mallets or air hammers. Plastic refractories are used to build smaller furnaces, lay floors in slag-tap furnaces, build special shapes in place, patch walls. They usually harden only on the surface exposed to heat.

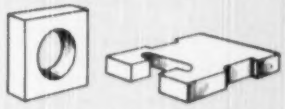
Castable refractories are handled like concrete and poured into forms. They harden in the same manner as concrete — by hydraulic setting. They are used for moderate temperature applications -- about 2500 F and under.

Refractory mortar bonds bricks to form walls, giving equivalent of a monolithic structure. It also seals up the joints to make a tight setting. Mortar may be sprayed or brushed on inside surfaces to seal joints and pores in brick for added protection.

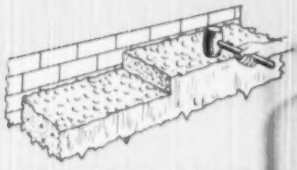
REFRACTORY FORMS



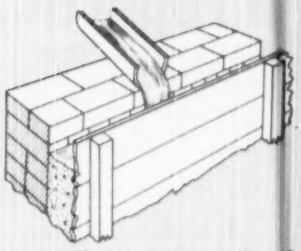
8 Wide variety of standard shapes eases furnace building problems



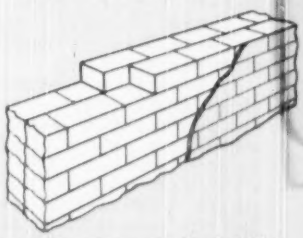
9 Special shapes are designed and ordered as needed from builder



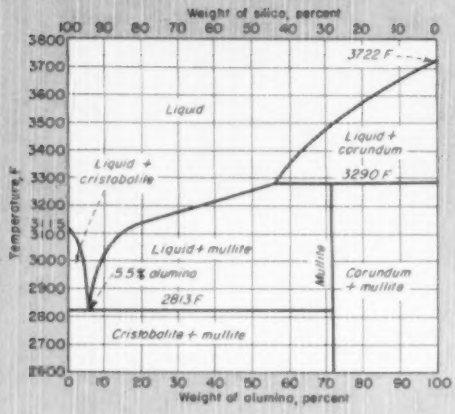
10 Plastic refractory may be pounded into shape in final location



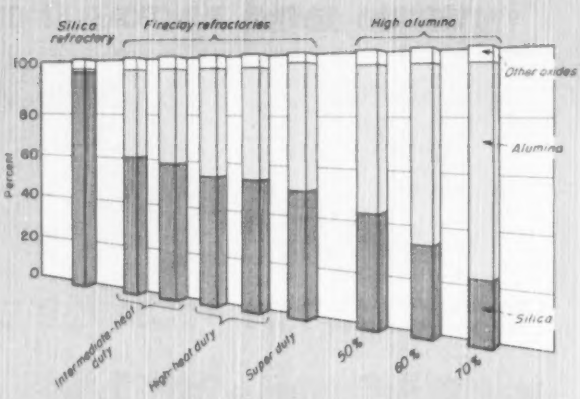
11 Castable refractories are poured into forms the same as concrete



12 Refractory mortar bonds bricks, may be used for coating surface



1 Equilibrium diagram shows melting temperatures of mixtures of alumina (Al_2O_3) and of silica (SiO_2)



2 Some refractories consist of mixture of two principal refractory oxides, alumina and silica, with small amounts of accessory oxides

Properties of Refractories

We have talked about what refractories must do, and how they are prepared. Now let's examine their actual characteristics and limitations a little more closely. First, what are refractories? One authority lists 195 types, many of them rare and, hence, costly. Table I lists the refractories of commercial importance, together with their melting points and source. Note that with the exception of silicon carbide and carbon they are all composed of oxides, that is, chemical combinations of elements with oxygen.

To consider any refractory as a simple chemical formula, however, over-simplifies actual conditions. The melting point, which is of major importance, depends on how the compounds are proportioned. These oxides combine in different crystal forms as their ratio varies and so produce different minerals. For example, mix two oxides. Melting point of the mixture differs from that of the pure oxides. Fig. 1 shows this variation for mixtures of pure alumina and silica. Pure silica melts at 3115 F. Adding alumina progressively lowers the melting point till 5.5% of the mixture is alumina. This mixture, known as the *eutectic* composition, has the minimum melting temperature. Further additions of alumina then raise the melting point until for pure alumina the melting temperature is 3722 F.

Most refractories are not mixes of pure oxides. Melting points are generally lower because of the presence of other accessory oxides. Melting of refractories proceeds differently from that of ice, for instance. It is a progressive change. A refractory begins to soften at temperatures considerably lower than its melting point.

Fig. 2 shows the approximate composition of those refractories consisting primarily of silica and alumina. These *fireclay* refractories are most often used in boiler furnaces.

SPECIFIC GRAVITY

To know how strong furnace foundations must be the designer needs to know weight of the brick per unit of volume, or the specific gravity. Because of the porous structure of most refractory there are two values for specific gravity, apparent and true. Apparent specific gravity includes volume taken up by the closed pores in the refactory, true specific gravity doesn't.

Fireclay refractories have specific gravities varying from about 2.5 to 2.75. Their bulk densities vary from 120 to 150 lb per cu ft. Insulating firebrick, with many closed pores, has densities of 18 to 50 lb per cu ft. Silicon-carbide refractory has a specific gravity of about 2.6, bulk density of 165 lb per cu ft.

THERMAL EXPANSION

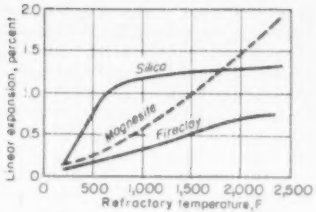
Like most other materials, refractories expand when heated. This factor becomes important when we realize that furnace temperature runs all the way from normal room values when shut down, up to 2500 F and higher when running. Fig. 3 shows the linear thermal expansion for various kinds of refractories. These expansions are reversible, meaning that when cooled the refractory returns to its original dimensions. Furnace-wall construction must allow the refractory to take on the added dimension when hot or the wall may fail.

On first heating in service most refractories undergo small permanent changes in dimensions. This occurs before reaching softening temperature. When overheated, dimension changes (shrinking or swelling) become large.

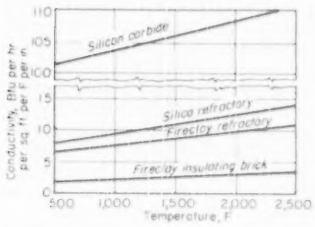
STRENGTH

When used in furnace walls of steam boilers, refractories need carry only their own weight and whatever part of the wall is above them. Refractory structures never carry any part of the boiler or its structural support. Naturally, the most important angle is that refractories must have enough strength to do their job when the furnace runs at working temperature.

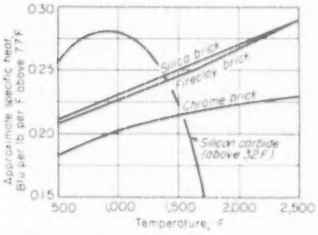
Refractory strength tests are usually made at room temperature, Fig. 6. They give a rough index of working characteristics but, more important, tell whether a refractory shape has



3 Reversible linear expansion varies with refractory's temperature level



4 Thermal conductivity depends on type of refractory, manufacturing method

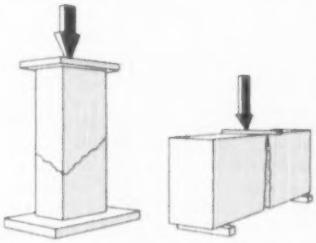


5 Specific heat of a refractory determines amount of heat to warm it up

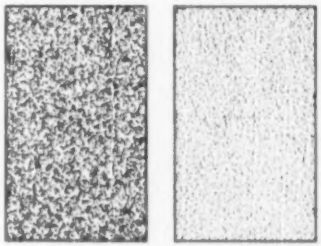
PRINCIPAL REFRACTORY MATERIALS

Mineral	Formula	Melting temp, F	Sources
Silica (Cristobalite)	SiO_2	3142	Quartzite, sand
Kaolinite	$Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$	3245	Fireclay, kaolin
Mullite	$3Al_2O_3 \cdot 2SiO_2$	3326*	Kyanite, sillimanite, Andalusite, electric furnace melts
Forsterite	$2MgO \cdot SiO_2$	3434	Olivine
Alumina (Corundum)	Al_2O_3	3704	Bauxite, Diaspore
Chrome ore	$(Fe\ Mg)O \cdot (Cr\ Al\ Fe)_2O_3$	Above 3578	Chrome ore
Spinel	$MgO \cdot Al_2O_3$	3875	Synthetic (electric furnace)
Silicon carbide	SiC	Dissociates above 4532	Synthetic (electric furnace)
Beryllia	BeO	4550	Beryl
Dolomite (burned)	$CaO \cdot MgO$	4532	Dolomite
Zircon	$ZrO_2 \cdot SiO_2$	4622	Zircon sands
Lime	CaO	4658	Limestone
Graphite	C	**	Carbon (coke, anthracite)
Magnesia	MgO	5072	Magnesite, sea water

*Dissociates into corundum and liquid. Entirely liquid at about 3470 F.
**Carbon in all forms volatilizes without melting at ordinary pressures.



6 Compressive and transverse strength tests determine suitability of brick



7 Number and size of pores in refractory fix amount of heat it transfers

been properly manufactured. Cold strength also becomes important in handling and shipping refractory shapes where they become subject to considerable mechanical abuse.

Some typical ranges of cold crushing strengths are:

Fireclay brick ..... 1200 to 12,000 psi
Insulating brick ..... 50 to 500 psi
Chrome ..... about 6000 psi
Silicon carbide ..... about 16,000 psi

Besides crushing, strength is measured by placing a brick on two supports, parallel to each other and exerting a downward force until the brick breaks, Fig. 6. This property, known as the modulus of rupture, is the stress in the extreme fibers of the brick just at the point of failure. This varies from 700 to 2500 psi for fireclay, and 600 to 1200 psi for high alumina refractories.

THERMAL CONDUCTIVITY

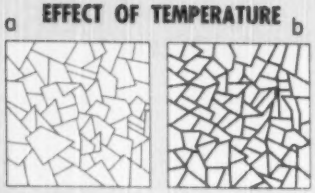
To control heat flow effectively, a refractory should have low heat-transfer ability. Nature of the material controls this as well as its density or porosity. Comparing two bricks of the same material we find the heat conductivity varies almost directly as the weight per cu ft. This relationship is demonstrated by the insulating firebrick; it has a characteristically low density and low thermal conductivity, as in Fig. 4.

Heat travels through a refractory by conduction, convection and radiation. Conduction is decreased by reducing the amount of material in a given volume or, in other words, by increasing the number of void spaces, Fig. 7. Heat travels across these voids by convection. Air or gas trapped in these voids circulates, picking up the heat at the hot end of the pore and giving it up at the cooler end. Because of the small size of the pores, these convection currents are negligible. A considerable portion of heat flow at high refractory temperature may be caused by direct radiation across the larger pores. Controlling cavity size helps to minimize heat flow by this method.

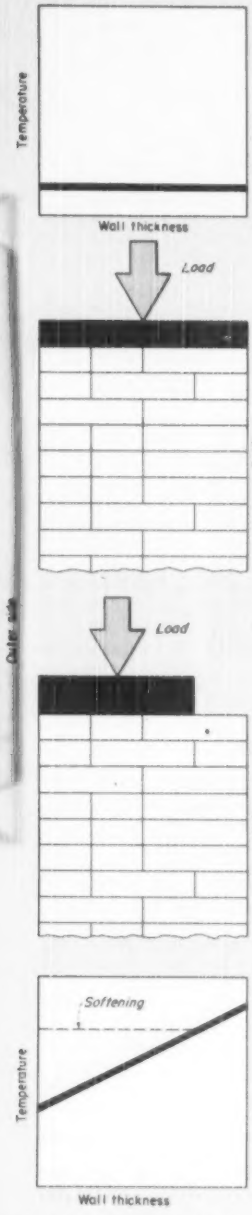
Over-all thermal conductivity also depends on the temperature of the refractory, Fig. 4. High conductivity of silicon carbide may be used to advantage in air-cooled and water-cooled boiler walls, helping to cool them.

HEAT CAPACITY (SPECIFIC HEAT)

As furnaces are heated from cold condition the refractory material ab-



8 Refractory softens because glassy bond melts, reacts with crystals



9 When wall is cold, the full section supports the load; in service, only the cooler outer section can support it

sorbs a certain amount of the energy. This heat can be partly recovered in a steam generator when it goes off the line. A small part goes to make some steam, but most of it goes up the stack.

This characteristic is measured by the specific heat, the Btu per lb per F temperature rise. It varies with the material and the temperature range, as in Fig. 5. A furnace with a high specific-heat material takes longer to heat. This factor is usually of more importance in process furnaces than in steam boilers.

Insulating firebrick by virtue of its low density has a low over-all heat capacity. This is an advantage in frequent intermittent operation.

PERMEABILITY AND POROSITY

Permeability refers to the ease with which gas and air flow through a refractory. This depends on the porosity of the material and the degree to which these pores interconnect. Such flow also depends on the pressure differential across the furnace wall. For normal boiler furnaces, permeability measures the ability of the wall to limit air leakage into the furnace. Though this flow helps to lengthen refractory life by cooling action, it decreases combustion efficiency.

In the reverse flow direction, low permeability is needed in pressurized furnaces now being built by some manufacturers. Here gas leakage through refractory must be limited. As far as an entire furnace wall is concerned, the mortar joints and expansion joints are more likely places for leakage than the body of the refractory.

High porosity becomes a disadvantage where heavy slagging action takes place within a furnace. Molten slag can work into open pores and by heating and chemical action cause disintegration of the refractory. For this reason insulating firebrick should not be used where slagging occurs.

How Refractories Behave

Refractory compounds, as our discussion has shown, have no definite melting temperatures. They start softening at certain temperatures and gradually become more liquid as temperature keeps increasing. In any furnace a refractory should be used whose softening temperature is well below the highest service temperature it will have to withstand.

Fireclay brick, for instance, consists of refractory mineral crystals, held together by a glasslike bond, Fig. 8a. The glassy bond depends on flux materials in the refractory mixture. At high temperatures these fluxes cause other refractory minerals to soften and fuse at levels lower than their normal fusing temperature. Fluxing compounds usually contain oxides of iron, calcium, magnesium, sodium or potassium, or any combination of these elements. By keeping flux content low only a small amount of high-temperature glass forms.

Heating refractories for long periods or to excessive temperatures eventually causes the ceramic bond to melt. This is called *vitrification*. This flux reacts with the refractory crystals in the immediate vicinity, causing them to soften and melt in turn. At this stage the refractory consists of a rigid porous structure and a liquid filling the voids between mineral grains. Further heating changes this structure to one where separate mineral crystals are held together by the very viscous liquid, Fig. 8b. At this condition an individual brick holds its shape, but any load on it causes it to deform. At still higher temperatures the liquid viscosity decreases to a point where the refractory fails, usually by shearing. If it carries any load it fails quite suddenly.

Glass develops in a refractory at a slow rate. The amount depends on elapsed time as well as temperature. For this reason, the way a refractory is fired during manufacture controls its characteristics.

Excessively high temperatures change the dimensions of refractory shapes. Glass formation and changing mineral composition often cause shrinking in fireclay refractories. High-alumina compositions behave like fireclay, but deform and fail at higher temperatures. Silica behaves quite differently; liquid forms rapidly and has much lower viscosity. It fails at temperatures very close to its melting point. Silicon carbide does not soften or fuse below its dissociation temperature of over 4000 F. Bonding materials consist of fireclay, phosphate and other chemicals; these control the high-temperature strength of silicon-carbide.

STRENGTH

Furnace face of a refractory wall runs at the highest temperature and is

the first part to soften or deform. Fortunately, temperature decreases sharply toward the outside surface. The outside-face temperature is usually only one or two hundred degrees above that of the room. Fig. 9 shows, in the upper graph, the uniform wall temperature when the furnace is cold. In this case, the load or weight of brick above any level in the wall is spread uniformly over the cross section, and all the bricks below carry it. Lower graph shows the temperature drop through the wall thickness from the furnace face to the outer face when the furnace is hot. If the furnace face should be heated above the softening point, the brick load at any level would be carried only by the cooler section of the wall. We might think of the hot ends of the bricks being carried through a cantilever action by the colder section of the wall.

Refractories creep, as do metals, when given extended service under load at normal working temperatures. This very slow plastic flow takes place at temperatures well below the softening point of the refractory.

DISINTEGRATION

When attacked by some furnace gases, refractories may completely disintegrate. At temperatures around 800 to 900 F, carbon monoxide, in the presence of catalysts such as iron oxides, decomposes into CO_2 and carbon. When this takes place in the pores of a refractory the carbon deposits at catalyst grains. Continued building up of carbon eventually causes the brick to burst and fall apart in small pieces. Some hydrocarbons under so-called cracking conditions may also disintegrate a furnace wall locally. Silicon-carbide brick can be oxidized under some conditions, leaving free silica and making the refractory more susceptible to fluxes and reducing its strength.

Rapid heating and cooling also causes disintegration of lighter refractories. This occurs most when the refractory has become partly vitrified.

Dense firebrick is attacked by CO only on its surface. Also, brick free of iron oxides is not destroyed by CO. Iron oxides, fused into the refractory as iron silicates, do not act as a catalyst.

SLAGGING

Slag accumulations on furnace walls can produce destructive fluxing action. Principal fluxes that attack fireclay, for instance, are oxides of sodium, potassium, calcium, magnesium and iron. These occur in the ash of coal, oil, wood, bagasse and other fuels.

Extent of slag attack depends on many factors. Temperature is the prime condition to start fluxing or melting action. Amount of flux in the slag naturally controls the action. Penetration of the slag depends on the refractory density, fluidity of the slag and viscosity of the reaction product. Temperature gradient through the refractory controls penetration also. As the flux travels into the brick it cools, becoming so viscous it cannot move farther into the pores.

When reaction products are very fluid they flow, carrying away grains of the refractory and constantly exposing new surfaces to the attack. Viscous reaction products, on the other hand, coat the refractory surface and often protect it from further attack.

ABRASION

Refractories in some applications may be worn away by the cutting and scouring action of solids carried in the combustion gas, or by the abrading action of furnace tools. In stoker-fired furnaces, moving fuel bed and clinkers may give the adjacent wall considerable hard wear. To withstand these actions refractories must have high mechanical strength and toughness in addition to other needed properties.

SPALLING

Refractory *spalls* when it cracks and breaks away at the surface, leaving new areas exposed to the furnace heat. Causes of spalling may be divided as follows:

1. Uneven heating and cooling within the brick causes unequal expansion and contraction, which set up internal stresses in the material. When these local stresses grow beyond the elastic limit of the refractory, it cracks, and so relieves the tension.
2. Compression in the refractory structure is caused by expansion with increasing temperature. Compressive stresses exceeding the elastic limit crack the refractory in relieving the strain.
3. Variation in coefficient of thermal expansion, between surface layer and body of the brick, may result from slag penetration or internal structural change while in service.

No. 1 is often considered the only basic cause of spalling as this type depends on inherent characteristics of the refractory itself. No. 2 nearly always results from poor furnace design. No. 3 can be minimized by using bricks burned higher than their operating temperature and by taking steps to prevent slag penetration, such as, coating the refractory surface with a mortar to close the surface pores.

While silica brick show poor resistance to spalling at low temperatures, at higher temperatures in their operating range, resistance is excellent. This results from their very small expansion in the high-temperature range.

Chrome and magnesite brick, having a high coefficient of expansion, are not as resistant as fireclay brick. But recently they have been improved by manufacture with a more flexible internal structure. Silicon-carbide brick have excellent spalling resistance as well as high strength and density.

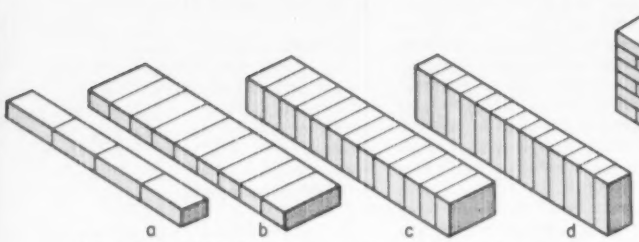
To test spalling, brick are heated to a high temperature according to a specified schedule, and then cooled with an air-water blast. They are cooled and heated alternately for about 14 cycles. After this treatment, spalling is evaluated by loss of weight suffered by pieces cracking and falling off the brick. Some typical results of these tests for fireclay brick are given in the following table:

Manufacturing method	*Brand*	*Weight loss, %*
Handmade	A	12.8
	B	8.0
	C	6.3
	D	21.0
Stiff-mud	E	25.0
	F	28.0
	G	20.5
	H	2.5
	I	0.5
Dry-press	J	14.8
	K	5.5
	L	13.0
	M	2.0
	N	1.0

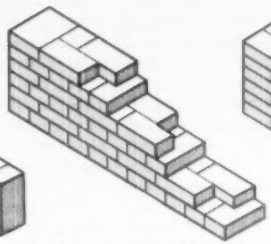
Compression loads caused by expansion greatly augment spalling. Expansion joints should be left at least every 15 ft and should amount to ¼ to 1 in. Another method places a slip of thin cardboard between bricks in each vertical joint, or thicker pieces between alternate joints. These burn out in service and allow each brick to expand freely. Despite the individual expansions there is no general movement of the wall changing the overall dimensions.

One authority feels there has probably been too great a tendency to specify brick with good spall-resisting quality as judged by laboratory tests. Many cases show that a hard dense brick stands up in service far better than one with a good spall-test record. These incidents probably arise from mechanical loads, experienced in service, that are not reproduced in laboratory tests.

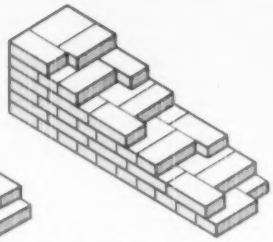
HERE ARE FUNDAMENTALS OF LAYING BRICK FOR WALL STABILITY AND....



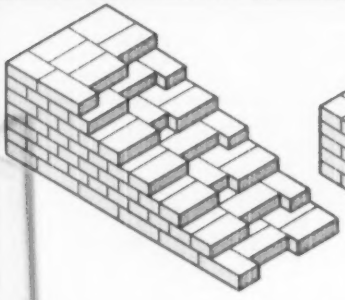
1 Four basic bricklaying arrangements are (a) stretcher course (b) header course (c) rowlock course and (d) soldier course



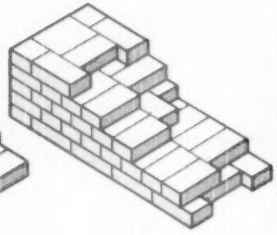
2 English bond for 9-in. wall alternates courses



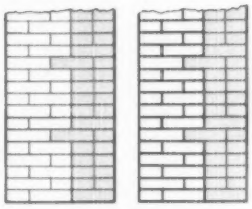
3 This 13½-in. wall has no joints through it



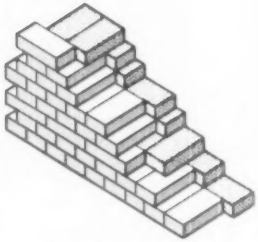
8 For high walls, 22½-in. thickness may be needed



9 Twin 9-in. wall construction to make 18-in. wall



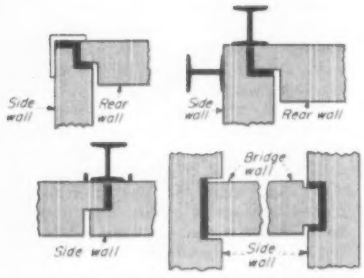
10 Thick joints accommodate thinner backup bricks



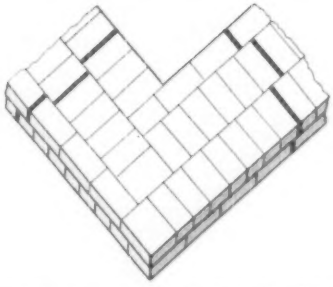
11 Use of insulating firebrick reduces heat loss

How to Lay Brickwork

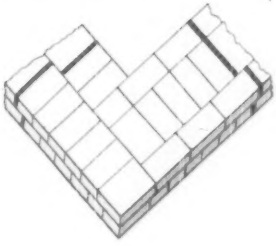
Brickwork must be (1) mechanically strong (2) airtight as possible (3) flexible enough to permit component parts of furnace to expand and contract with rising and falling temperature. Brick should be laid so walls can be repaired or relined as easily as possible and without weakening the wall. Dip faces of brick forming the joint in mortar and firmly slide and tap it into place to make a thin, tight joint. Stagger all joints to cut down air leakage into furnace or gas leakage out of it.



19 Expansion joints take many forms, may use asbestos rope for packing

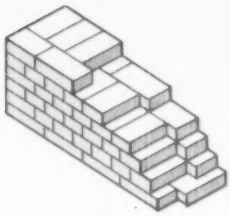


20 Corner construction for 18-in. wall with the expansion joints staggered

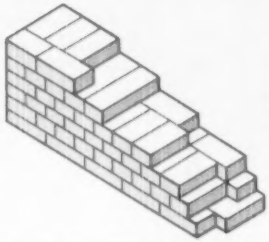


21 Corner layout, for 22½-in. wall, also has the expansion joints staggered

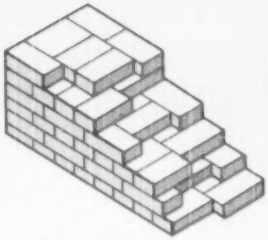
... TIGHTNESS WITH ENOUGH FLEXIBILITY TO ACCOMMODATE EXPANSION



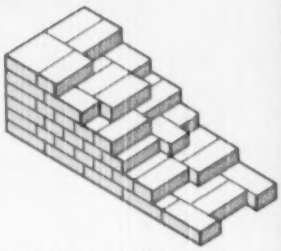
4 This 13½-in. wall is laid to make its repair easier



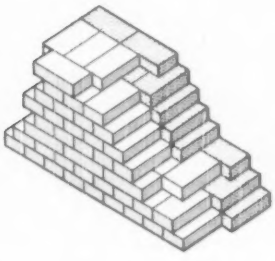
5 Every fifth header course has 13½-in. brick in it



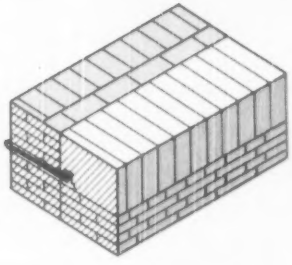
6 18-in. wall has alternate header, stretcher courses



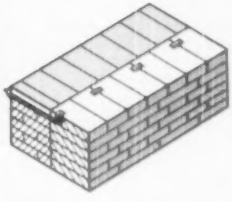
7 18-in. wall laid out to make replacements easier



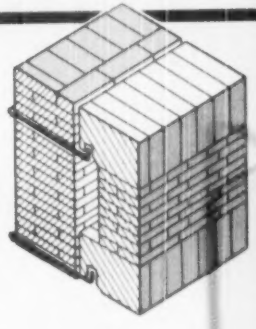
12 An 18-in. composite insulating firebrick wall



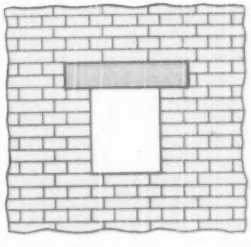
13 Tying-in firebrick tile to outer red-brick wall



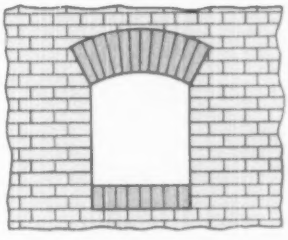
14 Tying anchor firebrick to outer red-brick wall



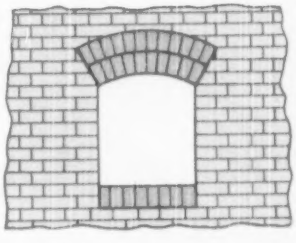
15 Tying firebrick and red brick over an air space



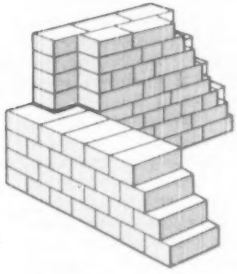
16 At peepholes, use square-edge tiles as lintels for support over opening



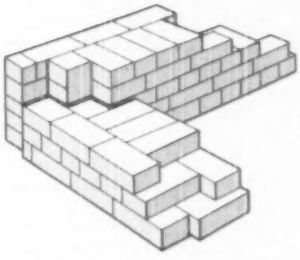
17 For fire-access doors use a single course of 9-in. wedges over opening



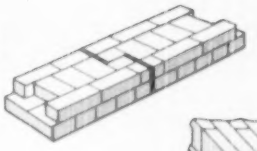
18 Alternate layout employs two row-lock courses in an arch formation



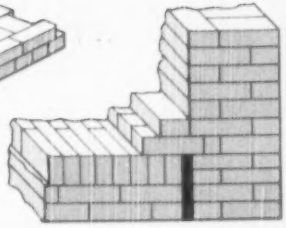
22 A corner expansion joint for 9-in. firebrick wall



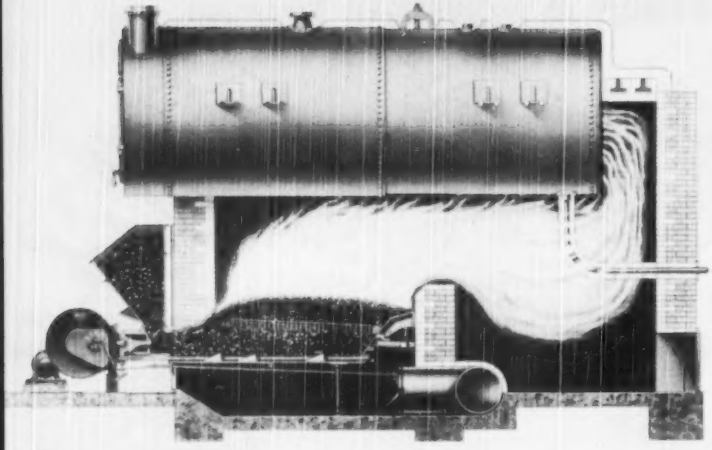
23 A corner expansion joint, 13½-in. firebrick wall



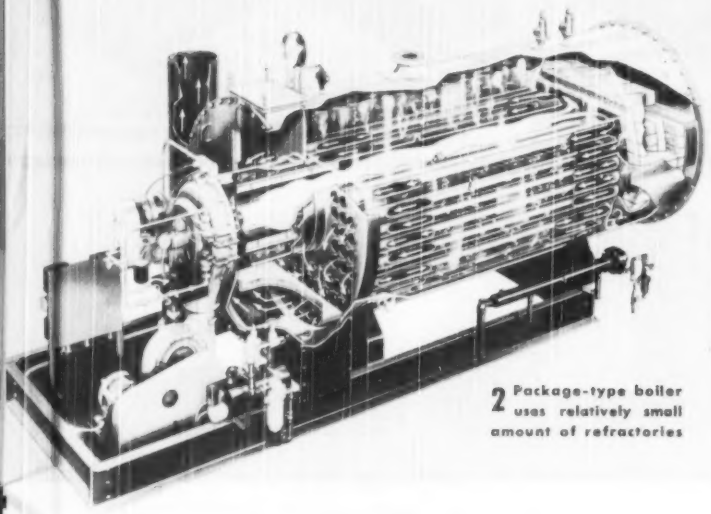
24 Expansion joints in an 18-in. firebrick wall



25 Expansion joint between furnace floor and walls



1 The hrt boiler needs refractories for complete furnace lining, bridgewall, floor, ashpit, blowoff line, rear arch. May be brick, plastic or castable



2 Package-type boiler uses relatively small amount of refractories

Refractory Applications

The American Society for Testing Materials has set up standards for classifying firebrick. These standards are measured against certain properties: pyrometric cone equivalent (PCE); deformation under load of 25 psi at 2460 F; permanent linear shrinkage; spalling loss for top-cycle temperature of 2910 F for high-duty brick.

PCE is a laboratory method of measuring softening or deformation temperature of ceramic materials. We'll give the temperature corresponding to PCE for each type in the list below:

Type A — High duty: For average furnace-wall conditions in heavy-duty furnace, 2400 F and higher.
PCE = 3074 F

Type B — High duty: For moderately severe spalling conditions.
PCE = 3074 F

Type C — High duty: For moderately severe conditions of slagging but not severe spalling.
PCE = 3074 F

Type D — Super duty: For severe conditions of spalling, slagging and high furnace temperature.
PCE = 3173 F

Type E — High duty: For division walls heated both sides.
PCE = 3074 F

Type F — Intermediate duty: For second- and third-pass boiler walls, and for backing-up brick.
PCE = 2984 F

Type G — Low duty: Backing-up brick for furnace and boiler walls.
PCE = 2768 F

For types *A, B, C, E* the standards specify that brick shall meet PCE *or* have deformation not less than 1.5% under loads of 25 psi at 2460 F. Type *F* may have deformation of 3% instead of the specified PCE. Types *A, B* and *C* may have permanent shrinkage of not more than 1.5% at 2550 F. Type *D* may have permanent shrinkage of not more than 1% at 2910 F and 4% at 3000 F. Spalling loss for type *A* may not be more than 15%, and for type *B* not more than 10%.

In selecting firebrick for particular applications these standards are of help. Type *D* has the best qualities in all aspects. Types *A, B, C* and *E* have one or more of these qualities, and the brick type should be selected according to the dominating quality needed for a given application.

For high walls with heavy load on the lowermost courses, choose a brick with low deformation. Where wide temperature variations occur, choose a brick with low spalling loss. A brick showing low water absorption on test should be chosen for severe slagging conditions.

Firebrick made of refractories other than fire clay find use in special services. Silicon carbide, for example, has desirable qualities for furnace linings adjacent to stokers. In addition to high refractoriness and load-carrying ability, it has high heat conductivity. Its high density and resistance to "wetting" helps prevent clinker adhesion and slag penetration.

Chrome has extremely high refractoriness and is chemically neutral to the ash of most coals. It has good load-bearing ability and its coefficient of expansion compares well with fire clay. Silica brick have been used in chemical-recovery furnaces of steam boilers in the paper industry. Often refractory selection is a compromise among the different properties.

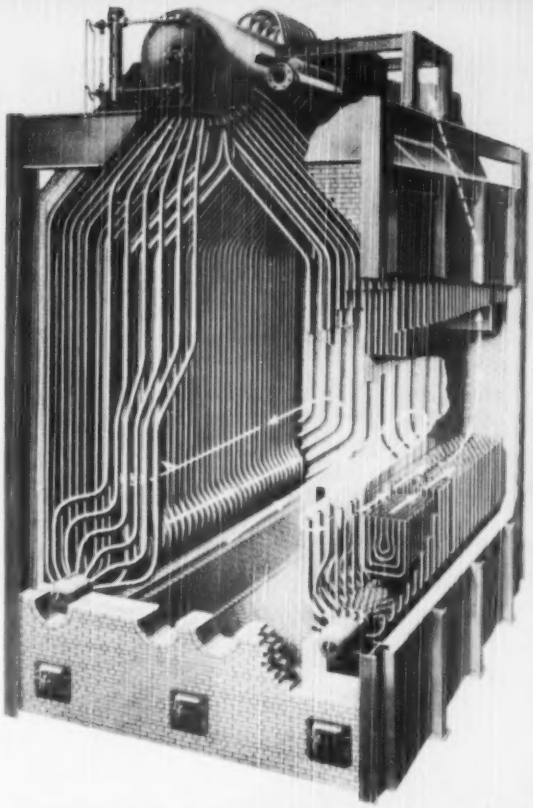
REFRACTORY USES

Demands that a steam generator places on a refractory depend on where it's needed. A wide variety of conditions must be met so one boiler will use several types of refractory. Let's look at some details that must be taken care of. In a furnace there may be walls, floor, roof, openings, arches, burner linings, tube entrance and exit seals, bridgewalls and door linings. Walls, arches and roof may be solid, or sectionally suspended. In the convection section of the boiler there are walls, roofs, baffles and sections to protect drum and intermediate headers. Refractories are also needed for lining ashpits, slag tanks, stacks, dampers, flues, ducts and cinder hoppers. In watercooled stokers there may be refractory lining for the clinker chills at the sidewalls. Other items needing protection include secondary air inlets, gates on traveling-grate stokers, etc.

Hrt Boilers. Furnace walls for hrt boilers, Fig. 1, usually consist of hard-burned common red brick with fireclay brick or monolithic linings. Boilers with a grate or stoker have at their ends a bridgewall high enough to contain the fuel bed. Wall linings in the furnace area, from boiler front to bridgewall are usually built 9 in. thick. To the rear of the bridgewall they may be only 4½ in. Oil- and gas-fired hrt's should have all the walls lined with 9 in. of refractory. In some designs, the roof at the boiler rear just above the firetube entries are built of arch bricks. In others, the roof may be refractory tile suspended from steel beams. Refractory protection must always be given the blowoff line since it crosses the path of the high-temperature gases leaving the fire. The red-brick wall carries the boiler weight in some units. In others, the boiler is supported from steel work. Never does the refractory carry any load other than its own weight.

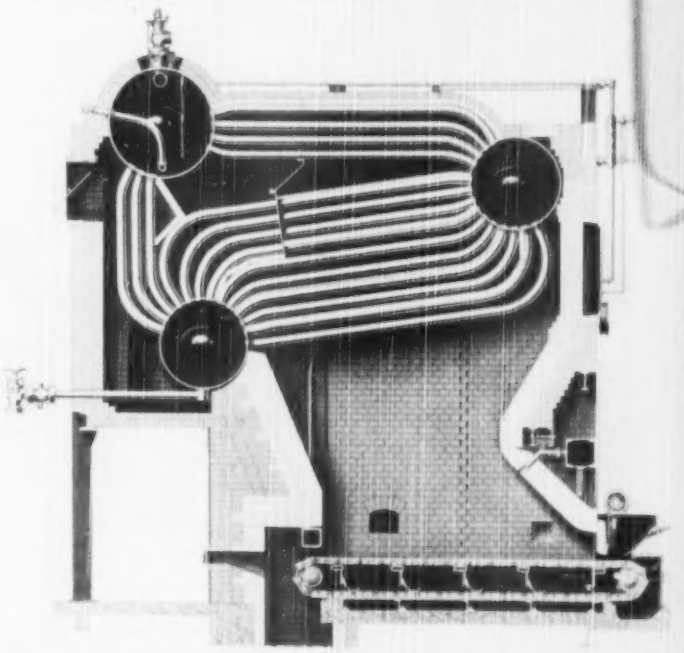
Where boilers are set in batteries, center walls should be built entirely of firebrick. Center cores of common brick do not stand up because they have no opportunity to cool. They have no high-temperature strength.

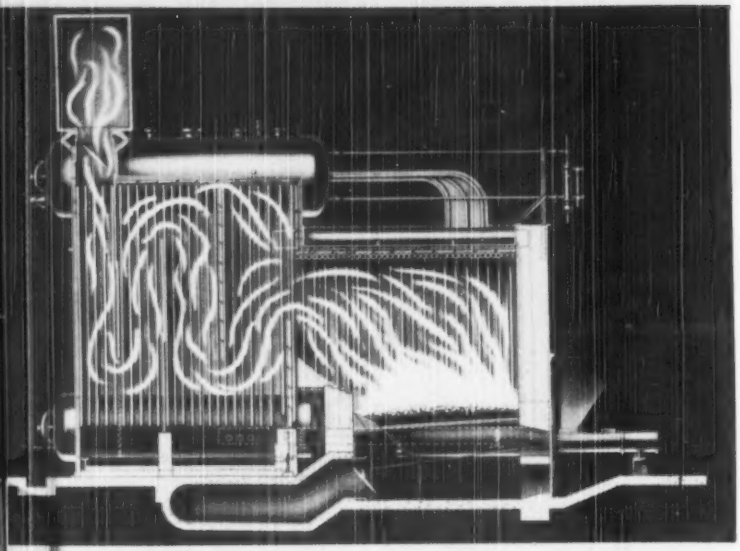
Occasionally hrt settings may be steel encased with insulation or insulating firebrick to reduce refractory-wall thickness, see Fig. 1, p 74. Any setting must permit brickwork to expand freely without interfering with the boiler, which also expands, often in the opposite direction. Insufficient expansion clearances on boilers have caused tube-seat leakage, shearing of boiler-support columns, wall buckling and lifting of the boiler off its supporting steel.



3 This boiler cutaway shows application and support arrangement of steel outer casing. Note refractory tile and insulation in sidewall and roof

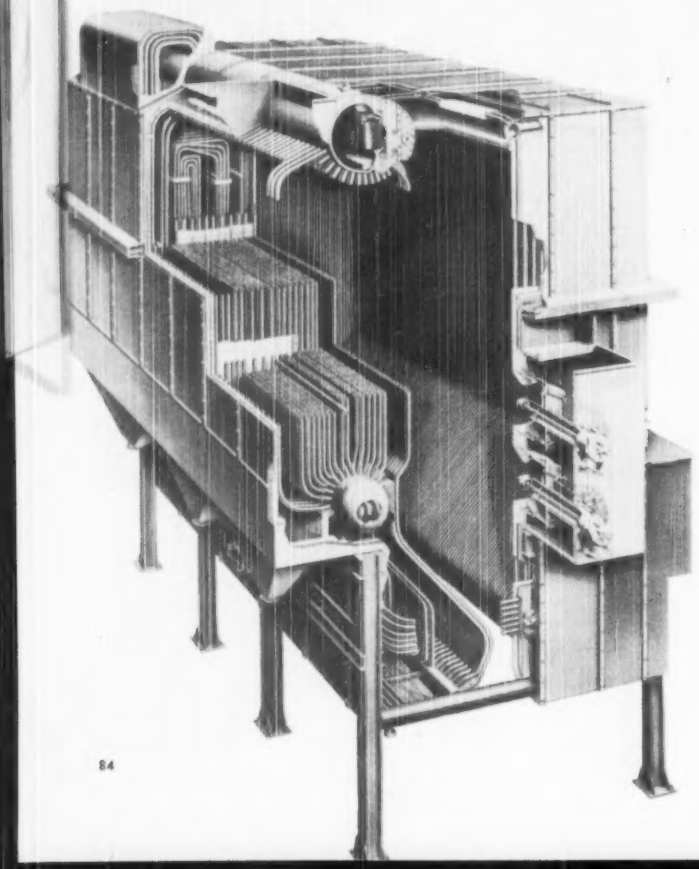
4 Chain-grate-stoker furnace has refractory-arch construction with air-jet ports. Tile on boiler tubes breaks up gas-flow stratification in passes





5 This boiler uses ship-lap tile in baffles and furnace roof. Front furnace wall is built of two different firebrick types, steel outer casing

6 This furnace, enclosed by closely spaced wall tubes, needs only refractory backing in lower ash hoppers. Refractory tiles form baffles, walls



Package steam boilers usually have high furnace-heat releases and are of internal-furnace design, Fig. 2. Most of the furnace surface is surrounded by the water in the boiler shell. These boilers need a minimum of refractory. As the section shows, in this particular design, refractory lines the front end of the furnace to do a twofold job. It (1) helps ignite fuel oil sprayed into the furnace (2) limits heat flow to the front-end reversing chamber. Only two other points need refractory protection in this unit, the rear reversing chamber and the front reversing chamber. There are a total of four gas passes through the boiler. The furnace requires a super-duty or silicon-carbide refractory, with successively lower-duty refractories in reversing chambers.

Watertube Boilers. Furnace settings of watertube boilers without waterwalls may have the solid-gravity type or sectionally-supported walls, or combinations of both. The most prevalent solid-wall construction uses hard-burned common brick for the exterior to support a refractory lining, Fig. 10, p 80. These walls usually have an over-all thickness of 18 to 22½ in. Furnace firebrick lining should be at least 9 in. thick. Walls enclosing the convection section of boilers need only 4½-in. firebrick thickness.

The firebrick bonds into the red brick by an arrangement of overlapping headers. Furnace-wall linings usually use four header courses to one stretcher course in height, Fig. 4 and 5, p 81. A header course overlapping a common brick header in the outside wall backs up the stretcher course. Linings of walls in boiler convection sections may be laid up with four stretcher courses to one header course, or with alternate header and stretcher courses, Fig. 2, 3 and 6, p 80. For this type construction, common brick may be replaced with any of several types of face brick or low-duty firebrick.

Walls of this type sometimes have insulating firebrick or block insulation on the outside. Wire mesh, attached to anchor wires built into the walls, holds the block insulation in place. This can be covered with an insulating cement and then painted.

Let boiler designer decide if walls are to be insulated. Adding insulation to walls not designed for it may cause failure by raising brick temperature to softening point. Casings use insulation between refractory and steel.

Monolithic linings of plastic firebrick or castable refractory are often used for both firetube and watertube boilers. Plastic refractory should be used only where the temperature reaches at least 2000 F. It must be burned or fired to develop the ceramic bond; this is called

heat setting. Where temperatures are under 2000 F use castable refractory because it hardens without preliminary heating.

A combination of plastic and castable refractory can be used for a complete setting. Furnace would be plastic and the remainder of the setting, subject to lower temperatures, of castable. Both materials should be installed with refractory or alloy-metal anchors fastened to the common-brick wall, similar to Fig. 13 and 14, p 81.

Sectionally-supported walls solve the problem of providing expansion space for the refractory and still avoid large expansion joints that are prone to allow considerable air leakage. By arranging the refractory in sections or panels, as in Fig. 10, p 86, the expansion joints can be kept thin. With a slip-seal arrangement, air leakage is kept at practically zero.

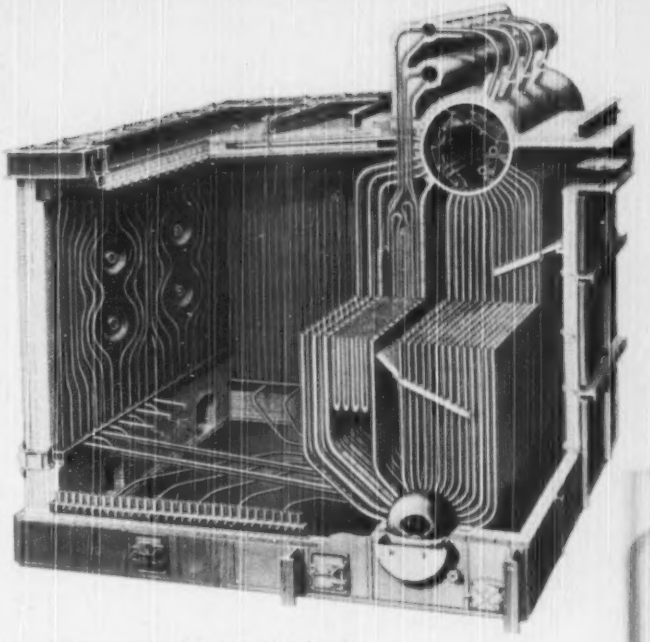
In Fig. 10, insulating firebrick and tile are carried on metal panels that suspend from the steel framework supporting the boiler. Hooks welded on the metal panels fit into the brick and tile, made with appropriate openings to keep the bricks in place. There are many patented sectional and suspended-wall layouts. Space does not permit full discussion here; a later special section will deal with these constructions in detail. They may be made of tile only, of tile with exterior insulation, or, as in Fig. 10, of insulating brick.

The latter are usually limited to walls in convection zones or for low-duty furnace walls when gas or oil are the fuels. They can be adapted to moderate-duty furnaces by facing them with high-temperature brick or by air cooling. With air cooling, a space of 8 or 9 in. separates the tile shapes from the outside wall or casing. Outside wall may be of insulating, common or face brick, or of low-duty firebrick. This wall generally measures 4½-in. in thickness, and is supported by the steel framework from which the special construction hangs.

Air space may be in vertical or horizontal lanes, see Fig. 15, p 81. The cooling air flowing through these lanes eventually enters the burner or stoker windbox, or may enter the furnace directly to support combustion.

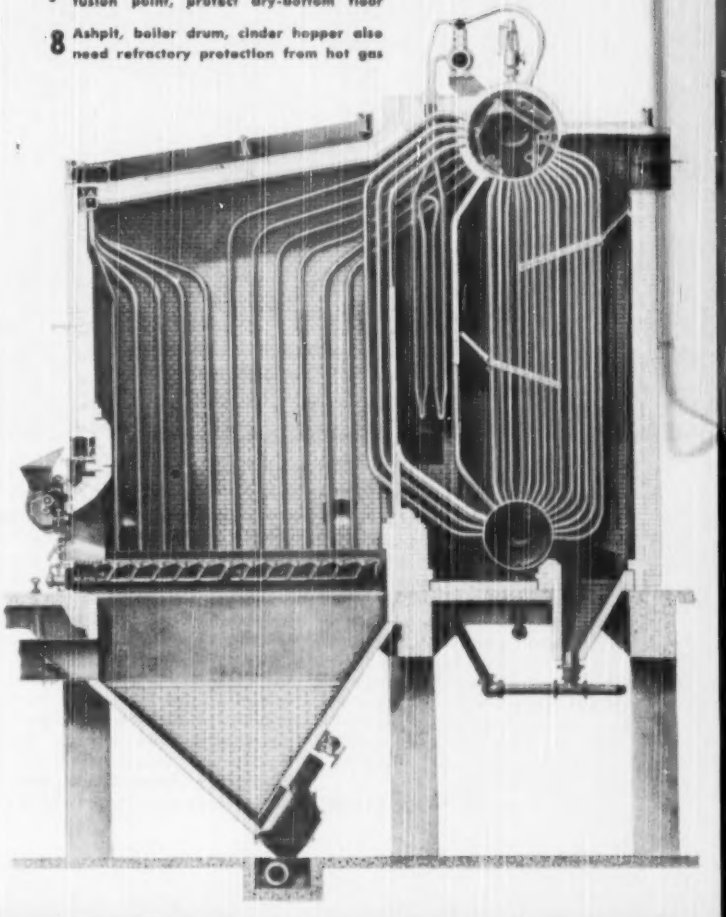
Watercooled walls are arranged in a great number of ways. Though these waterwalls absorb direct heat of the furnace, they must be backed up by refractory to form a tight enclosure for fire and gases. Fig. 3, 5, 6, 7, 8, 9 and 13 show some of many variations: bare tubes, finned tubes, tubes partly embedded in refractory, etc.

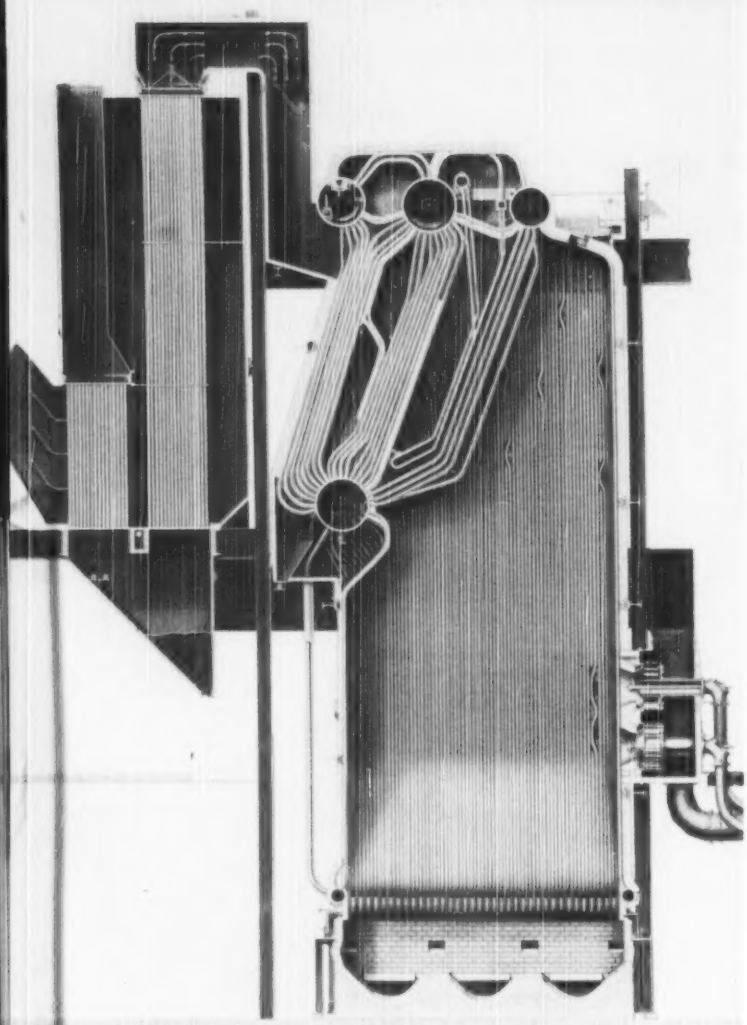
Some of these designs reduce the duty on the refractories, while others,



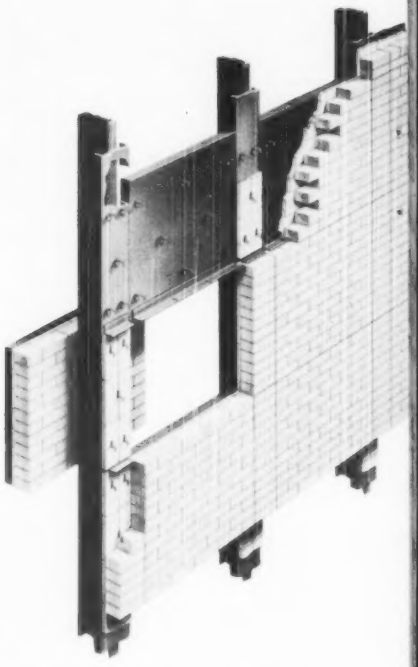
7 **Furnace screen tubes cool ash below its fusion point, protect dry-bottom floor**

8 **Ashpit, boiler drum, cinder hopper also need refractory protection from hot gas**





9 Area underneath ashpit needs protection from high temperatures. Refractory backing of wall tubes must be able to withstand slag action also



10 One of many types of sectional walls that eliminate wide expansion joints

using widely-spaced bare tubes a few inches in front of the refractory, have no practical effect. In the latter case, the furnace wall is usually designed as if no wall tubes were installed. Where tubes and refractory are brought in direct contact, special design precautions must be taken. In earlier designs the difference in expansion motions of the tubes and refractory was taken care of by slip seals and packed expansion joints. The large amount of maintenance work needed to keep these tight led to other schemes.

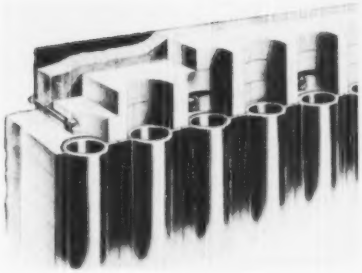
In many modern units the waterwall tubes support the refractory backing with no provision for slipping between them. Various types of steel beams, channels and tiebars hold the tubes in place. The tubes support these reinforcements as well as the refractory.

Where bare tubes come in contact with the refractory, as in the left-hand wall of Fig. 6, they do a certain amount of wall cooling. This reduces the wall thickness needed so it can be made of thin refractory tile backed by insulation and steel casing. Where this arrangement undergoes tougher duty, as in the front burner wall of Fig. 6, full bricks instead of tile must be used. To insure resistance against slagging and flyash erosion the proper refractory must be applied. This usually means selecting firebrick able to withstand appreciably higher temperatures than it actually will experience in this service.

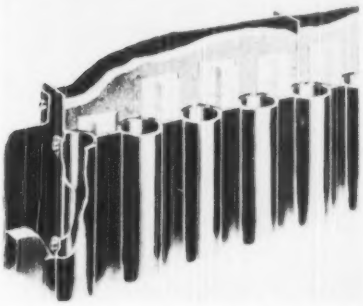
Laying up the tile or brick in an air-setting mortar insures tightness against air infiltration, and also gives a strong wall structurally. Backing up the wall with castable refractory reinforced by expanded metal lath serves to keep out air in the final high-draft passes of the boiler.

Some designs proportion the wall-tube spacing to make the refractory temperature change just double that of the wall tubes when in operation. Since the coefficient of expansion of steel is just about double that of the refractory, both materials will expand the same amount. This eliminates any need for expansion joints.

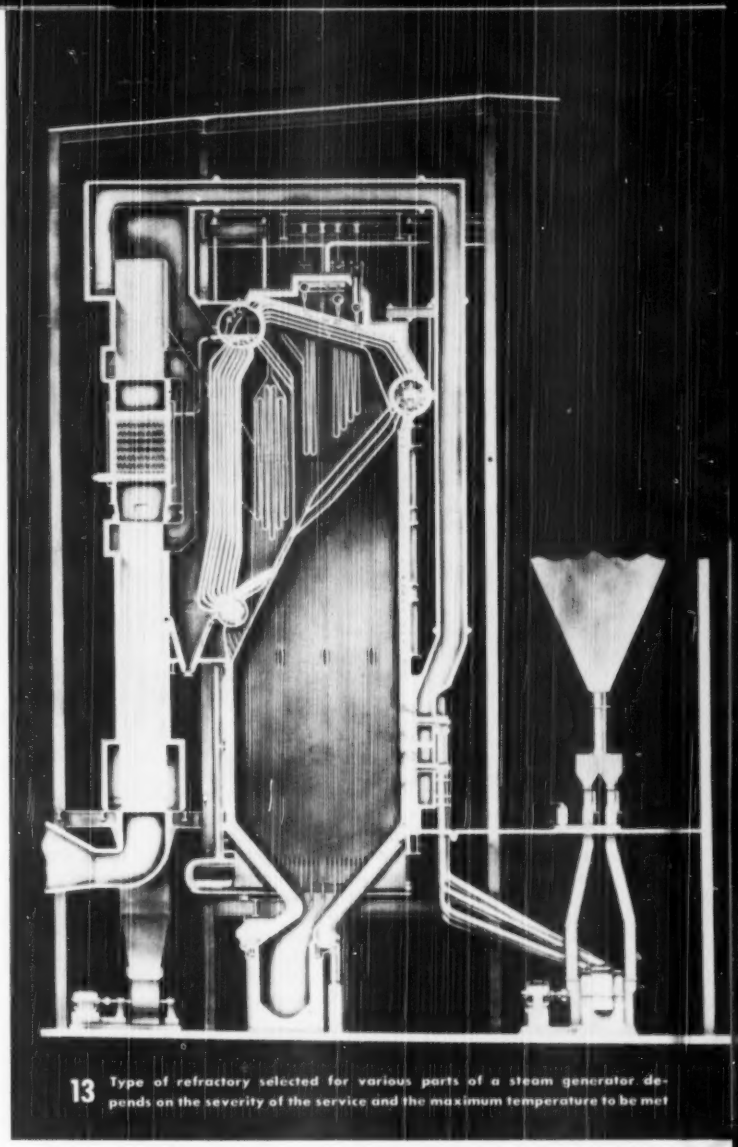
Fig. 6, 9 and 13 show furnace waterwalls made up of closely spaced tubes. These walls usually have no trouble withstanding slag accumulations. They may be sealed by backing up with castable insulating concrete, block insulation and a steel casing. The expansion coefficients of the steel and castable



11 Waterwall with firebrick, insulation and steel casing for backup, sealing



12 Waterwall tubes with refractory and sectional wall suspension in back



13 Type of refractory selected for various parts of a steam generator depends on the severity of the service and the maximum temperature to be met

refractory are slightly different. This causes a series of hairline cracks to be distributed throughout the wall area. Despite these the wall is much tighter than one with expansion joints.

Fig. 11 and 12 show waterwall arrangements using finned tubes. These give the same effect as a closely spaced tube wall. The fins keep the refractory backing at the boiler-water saturation temperature. Fig. 11 has specially shaped brick backed up with insulation and a steel casing. Fig. 12 is another form of sectionally suspended wall adapted to waterwalls. Fins are backed up with 2-in. refractory tile. These, in turn, are backed up by panels of 2 to 3 in. of insulating material carried by steel panels.

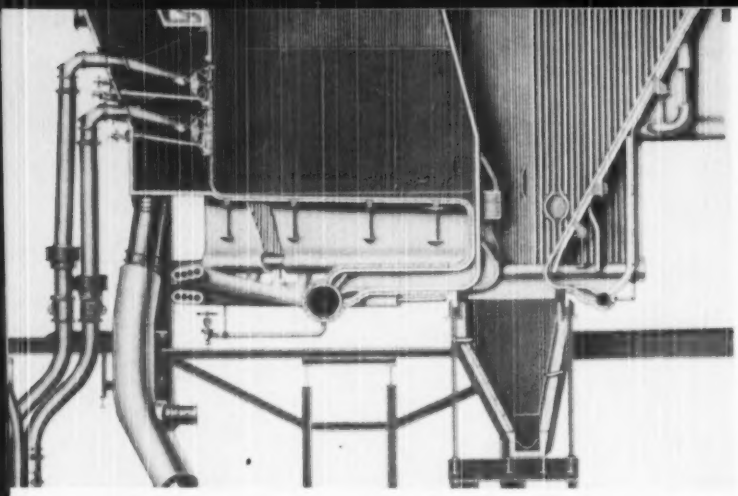
When a completely watercooled furnace must carry a higher combustion temperature, some manufacturers use studs welded to the wall tubes on the furnace side. The space between the studs is then packed with a chrome-ore refractory. This construction finds use in slag-tap furnaces where molten ash, flowing down the walls, must be kept above its melting temperature.

Floors of slag-tap furnaces are usually built up of closely spaced boiler tubes covered with chrome-ore plastic refractory pounded into place. The floor under the tubes consists of fireclay tile and block insulation.

Fig. 3, 7 and 9 show methods of providing dry-ash bottoms for pulverized coal-fired furnaces. More than a single layer of refractory must be installed to limit heat losses to the ground. The refractory must have high spalling resistance if ash is removed by water sluicing, to withstand the thermal shock caused by the water. Even if ashes are raked out, in-flowing air causes sharp temperature drops. Fig. 1, 5, 8 and 13 show various arrangements for building ashpits. They are built of castable or brick refractory. High spalling resistance is also needed here.

Fig. 4, 5, 6, 7, 8, 9 and 13 show various methods of roof structure. In practically all of these the supporting boiler tubes cool the refractory. Depending on the spans involved, the boiler tubes, in turn, may be supported from beams. The same general principles must be followed as for furnace walls.

Baffles direct gas flow over the boiler-tube exteriors to ensure maximum



14 **Floor and lower walls of slag-tap furnace must be chemically neutral to avoid reacting with iron in fluid ash. Chrome-ore refractory satisfies this need**

utilization of heat-transfer surface. To form an effective barrier to flue-gas leakage they must seal around each boiler tube that pierces the baffle. This becomes important as the draft drop through the passes increases. Though baffles are effectively cooled by the boiler tubes that support them, a high-duty refractory should be used to ensure ample resistance to erosion and to give sufficient strength. Baffles may be made of (1) castable refractory reinforced by metal rods (2) tile or (3) brick shapes. Fig. 4 illustrates tile laid on boiler tubes to form strips over the full width of a gas pass to help break up flue-gas stratification.

Fuels fired and the method of introducing them in the furnace dictate the refractory to use in some instances. On hand-fired grates the refractory must withstand the shock of cold air entering through open firing doors. Sidewalls and firing-door areas must resist abrasion from slice bars and other firing tools. High-duty brick generally proves adequate. Five courses of silicon carbide at grate level may be used for longer life.

Chain- and traveling-grate stokers usually need a short ignition arch to start fuel burning as it enters the furnace. A rear arch helps to form a throat to ensure adequate mixing of gases and complete burning before entering the boiler passes. Refractories forming these arches must resist erosion and spalling caused by vitrification proceeding over a long time. Sidewalls must be ready to withstand severe abrasion at high temperatures from clinker riding on the stoker grate. At the stoker line they may also be subject to high-temperature reducing action. Depending on circumstances, refractory should be of high or super-duty type, perhaps with silicon carbide at grate.

With underfeed stokers, super-duty or ventilated blocks are often used at the front and sidewalls to prevent clinker adhesion. The ventilated blocks pass air from the stoker windbox to the furnace through venturi-shaped openings in the blocks. Refractories at the stoker level must stand up under clinker adhesion and destructive forces set up by their removal. In addition, they must withstand slag erosion above the fuel bed, spalling and slag penetration. Refractories should be selected with regard to these severe conditions.

With spreader stokers the refractory must resist slagging, erosion and a given amount of abrasion and spalling according to the coal fired and the method of operation. For longest life, use silicon-carbide or super-duty brick for at least 12 in. above grate.

Pulverized coal probably gives the refractory the hardest service of any fuel. We have talked about the problems under waterwalls.

Oil-fired furnaces should be built to avoid flame impingement on the refractory furnace walls. Furnace walls may be either of solid or sectionally-supported construction. The refractory must be able to resist localized high temperatures and reducing atmospheres when the burners accidentally get out of adjustment.

To burn natural, coke-oven or blast-furnace gas the furnace must maintain hot areas to bring the fuel up to ignition temperature. Refractories in this service must withstand high surface temperatures as well as spalling caused by variable loads.

Successful wood burning depends on maintaining hot furnace walls to dry out the fuel before ignition. Wet wood requires an extension furnace built up of refractory. Dry wood, in contrast, can be burned directly under a boiler on a usual type of grate. Service conditions for the refractory are usually moderate, needing a high-duty fire clay.

Bagasse burning calls largely for the same refractory types as are satisfactory for wood.

Waste-heat boilers generally handle gases of relatively low temperature. Often, however, the gas may be loaded with flyash or other abrasive particles. For such cases dense, high-duty firebrick are recommended to attain the needed abrasion resistance.

Black-liquor recovery furnaces used in the paper industry are subjected to reducing atmospheres in smelting sodium salts out of the char. These are also chemically active. Plastic chrome ore covering completely watercooled walls and floor has been found to require little maintenance.

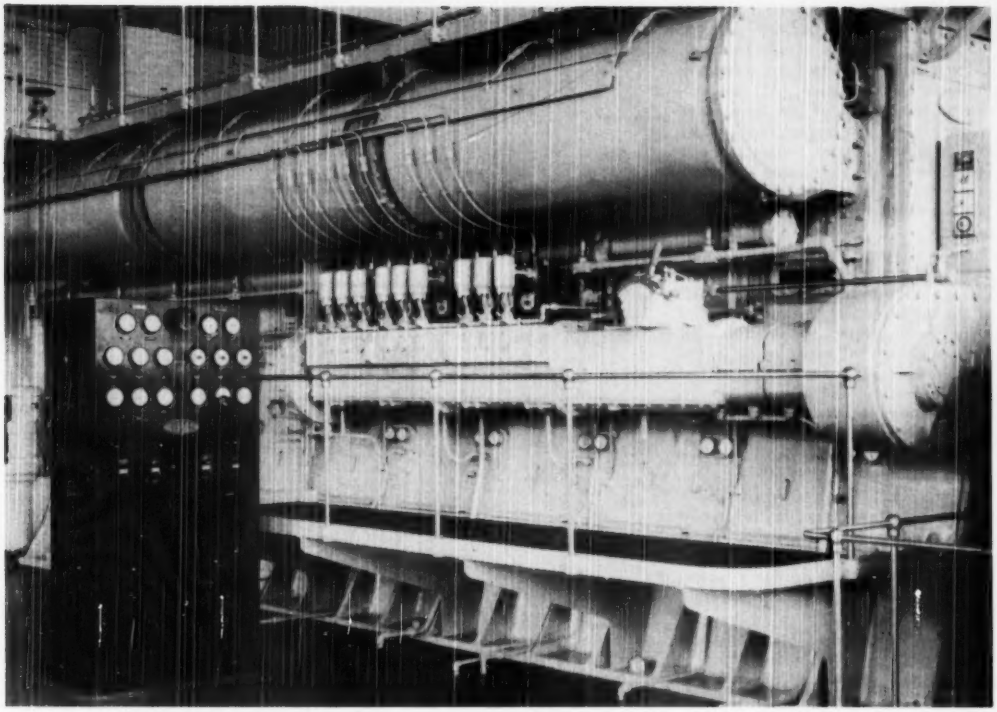
Starting a new furnace, or one that has fresh repairs, should be preceded by a slow drying-out. Using a low fire avoids excessive cracking and lets the walls, floor and roof expand slowly and uniformly. Brick setting of a large boiler should dry out over a period of a week to ten days. Smaller furnaces are dried out in a shorter time.

Life of brickwork depends on service conditions and may vary from about two to ten years. A life shorter than two years may mean that the wrong kind of refractory is being used or furnace design needs improvement.

ACKNOWLEDGMENTS

POWER is indebted to the following refractory-products manufacturers for supplying information used in preparing this special section:

Armor-Clad Co, Armstrong Cork Co, Babcock & Wilcox Co, Bernitz Furnace Appliance Co, Botfield Refractories Co, Brickseal Refractory Co, Carborundum Co, Philip Carey Mfg Co, Carolina Refractories Co, Chicago Fire Brick Co, Condenser Service & Engrg Co, Denver Fire Clay Co, M H Detrick Co, Joseph Dixon Crucible Co, Eagle-Picher Co, Ehret Magnesia Mfg Co, A P Green Fire Brick Co, General Refractories Co, Harbison-Walker Refractories Co, Johns-Manville, M W Kellogg Co, Keystone Refractories Co, Laclede Christy Clay Products Co, Lumnite Div, Universal Atlas Cement Co, Mexico Refractories Co, National Airoil Burner Co, Norton Co, Plibrico Jointless Firebrick Co, Power Plant Efficiency Co, Quigley Co, Ramtite Co, Refractories Co of North Carolina, Refractory & Insulation Corp, Saverite Engineering Co, Sanford C Smith Refractories Inc, H I Thompson Company, Waite Gravity Lock Refractories.



MODERN GAGE-ALARM CUBICLE serves large diesel in a central station. Controls prove just as important in small plants

Do You Run Your Diesel Plant by Ear?

No need to when instruments and controls will (1) tell you how it's doing (2) reduce operating errors (3) guide adjustments and maintenance (4) cut operating force required. First of a practical series

By E J KATES
Consulting Engineer
New York, N. Y.

► YOU'RE PLANNING a new diesel or gas-engine power plant, or perhaps modernizing an existing one. Naturally, you want to realize fully the high efficiency and reliability inherent in this type of plant. Early in the game you'll see what a big part instruments and controls play in getting the top-notch operation you want. Why are they so important?

Well, one big reason lies in the nature of modern power equipment. It's precision built to give high efficiency and maximum output from minimum space and weight. But closer design tolerances mean closer operating tolerances, too. To keep performance at high levels, you must operate on the beam, not hit or miss. And there's no room for human errors.

That's where instruments and controls come in—they tell you what's going on in the engine and auxiliary systems, automatically prevent operating errors, and, if need be, step in when something goes wrong. From their indications you learn when and where to make adjustments, when maintenance is needed. In other words, with the right instruments and controls in the right places, you'll know at all times what your plant is doing and how well it's doing it. And you'll be able to run it with a smaller operating force.

Plant Elements. We said "the right instruments and controls in the right places." What are they and where do they go? Let's start to find out by reviewing briefly the typical elements of diesel and gas-engine plants and see how they differ from other power units.

Heart of the plant is the engine. Here fuel burns *inside* the cylinders and expands to push the pistons and turn the crankshaft. If it's a diesel engine, air alone is compressed and fuel is injected at end of compression. If it's a dual-fuel or spark-ignition gas engine, both fuel and air are compressed. In either case, compression pressure is important and one of the things you'll want to measure. And, of course, fuel must be metered in accordance with engine load.

But the engine doesn't do its job all by itself. It needs auxiliary systems: (1) *intake system* to supply fresh air (2) *exhaust system* to carry away the products of combustion (3) *fuel system* to transfer oil or gas from point of supply to the engine (4) *cooling system* to keep engine temperatures at proper levels (5) *lubrication system* to ensure flow of lube oil to moving parts (6) *starting system* to get the engine rolling.

Each of these systems needs instruments and controls. You'll want to know pressure drop in the intake to tell when filters need servicing. You'll want to know cooling-water temperature and have some way of adjusting it to the right level. You'll want warning of low lube-oil pressure. And so on.

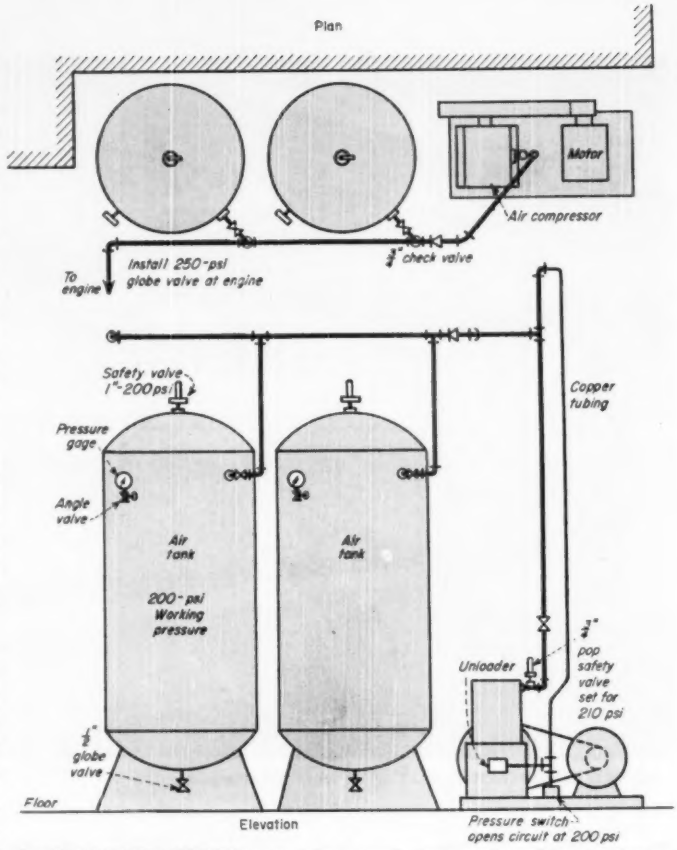
How Many Instruments? Just how many instruments and controls you'll need, and what kinds, depends a lot on the size of the plant and the nature of service. A small standby set doesn't need as many as a large central-station plant. Cooling-system controls for a single radiator-cooled engine can be less complex than those for a multi-engine plant with heat recovery from the cooling system. So when you sit down to plan that new plant, or improve your present one, you're going to have to use your judgment in deciding what instruments and controls you'll use and how you'll apply them. You can't expect the engine builder to work this out for you. This series of articles aims to make that job easier by telling what devices are commonly used in diesel and gas-engine plants and how they are applied in a practical manner.

What Controls Do. First, let's see what instruments and controls are supposed to do. Usually we want them to do one or more of the following jobs, and often all of them in sequence:

1. *Indicate or measure* some function, such as cooling-water temperature.
2. *Control or adjust it.*
3. *Sound an alarm* if it gets out of the safe range.
4. *Protect* engine and equipment from damage if safe conditions are not restored. This usually means stopping the engine.

Just how many of these you'll want in any particular case depends on the plant and its operating conditions. You'll probably agree that the first two steps are a "must" in most parts of most plants. You'll find the last two steps worth while in larger and more complex plants, under severe operating conditions, or where you want to cut operating attention to a minimum.

To get down to cases, let's take a look at each of the several systems making up a diesel or gas-engine plant and see what's needed in the way of instruments and controls. Putting first things first, we'll begin with the starting system.



STARTING-SYSTEM HOOKUP, typical for a small plant, consists of two air-storage tanks, motor-driven compressor. Note safety valves, unloader and pressure switch

STARTING SYSTEMS

Diesels and gas engines aren't self-starters. We have to turn them over by applying energy from some outside source. This may be done electrically, with energy taken from storage batteries or from the electrical system if the plant isn't isolated. Or we may use a small auxiliary engine to roll the main unit for starting. Commonest system in stationary plants uses compressed air. Since the layout of such a system falls usually to the designer of the plant, we'll concentrate on it here.

Basic parts of a compressed-air starting system are one or more air-storage tanks, a compressor and a piping system. Its job is to supply enough air, at the right pressure, to accelerate the engine quickly when the air is admitted to several engine cylinders. Valves for admitting air to the cylinders, and the hookup for timing them, are part of the engine and the responsibility of its builder. He'll usually specify pressure and quantity needed for starting.

The drawing shows a typical arrangement for a small single-engine plant. Basic principles stay the same for larger plants with several engines.

Tank Fittings. You'll want to install several tanks so one or more can be kept in reserve for use if pressure is lost in the active starting system. This might be caused by leaks or by difficulty in starting the engine. Equip each tank with a shutoff valve, drain valve and pressure gage. Check local laws and insurance requirements on tank construction and safety valves. Usually each tank must have one.

With the shutoff valves on each tank, you can work on any one while holding pressure on the others. With a pressure gage on each tank you can check pressure in reserve tank or tanks, regardless

of pressure in the active starting system.

Air compressor shown is motor driven. If you face the problem of starting the plant independent of outside power, you'll want to add a compressor driven by a small engine (usually gasoline) or rig the single compressor for dual drive—motor on one end, auxiliary engine on the other.

Compressor Controls. It's a good idea to equip the compressor with an unloader. This reduces starting load on motor or engine. You'll also find it desirable to fit your motor-driven compressor with a pressure switch connected to the tank header. Then desired pressure in active starting tank is held automatically. You can install another pressure switch, set lower, to sound an alarm or operate a warning light or annunciator, if pressure falls abnormally low.

Connect piping from unloader and pressure switch to discharge line through an inverted U. Then water generally found in discharge line won't get into these devices.

Discharge Valves. Install a safety valve on the discharge line close to the compressor, with a shutoff valve right after it. Shutoff valve lets you work on compressor while holding pressure on the starting header. The safety valve acts if compressor shutoff valve or all tank shutoff valves happen to be closed when compressor runs.

Put in another shutoff valve at the engine to keep pressure off engine-starting valves except during the actual starting period. You may find it a good idea to place a pressure gage at the engine so operator can watch pressure throughout the starting operation.

Globe or Gate? Experience shows globe valves to be better than gate for starting systems. They leak less with high-pressure air. Higher pressure drop in globes is not as serious with compressed air as with water or oil. Most starting-air systems operate at pressures under 250 psi so extra-heavy steel pipe and malleable fittings serve. Keep down number of joints to reduce leakage. Tanks should be good for system working pressure. Use copper tubing for pressure-switch connections.

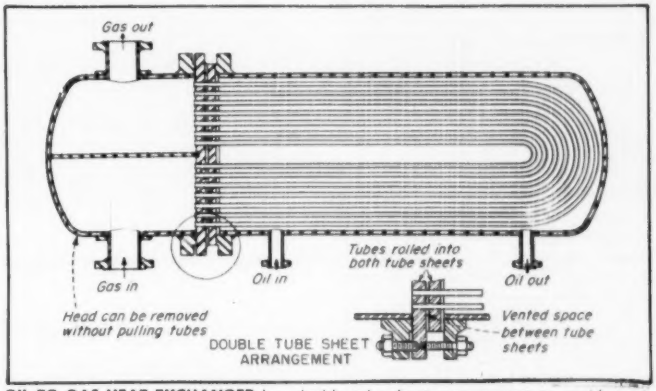
Gas From Pipeline Cools Engine Lube Oil

► THE SUCTION-GAS STREAM at pipeline compressor stations offers a possible cooling medium for small heat loads at moderate temperatures — engine oil coolers, for example. This form of oil cooling was first used on the compressor engine of a small field booster intended for automatic operation. Because of water scarcity and unattended operation, unit was designed to eliminate all cooling-tower services.

Oil-Cooler Design. Jacket heat load, too large to dump into gas stream, was dissipated by air coils. Oil heat load, quite small in this case, was picked up by cold gas flowing to the compressor suction. The drawing, right, shows a sectional view of the oil cooler used. A double tube-sheet arrangement avoided possibility of gas leaking into the oil through tube joints. A blowout head and automatic shutoff control protect cooler from damage in event of tube rupture. Provisions were made to trap and vent off any gas that might seep through pinhole leaks into the oil, but this has not happened to date.

The question naturally arises, "What about effect of higher suction temperature on horsepower requirements?" The amount by which horsepower per million cubic feet is increased is a deciding factor in determining the feasibility of such an installation.

Design basis for calculating compressor horsepower is assumed 60-F suction temperature. For six months of year, field gas reaches station at temperatures below the 60-F design level.



OIL TO GAS HEAT EXCHANGER has double tube-sheet arrangement to avoid possibility of gas leaking into oil through tube joints. No such trouble has occurred

During this period, true horsepower needed to handle station's load is less than design figure. Throughout year, station operates at a compression ratio essentially constant at 1.5. Under such operation, observed increase in gas temperature across oil cooler is 2 F. Applying this temperature correction to the basic horsepower million cubic feet figure, increase due to presence of suction-gas oil cooler is 0.3 of 1%. Even with additional consideration of pressure drop through exchanger (slightly less than one psi) power chargeable to cooler is about 1 hp for a 300-hp unit.

At $210 per hp, and $1000 for the exchanger, this would amount to $1210. Comparable cooling of a different type would have been more expensive to install and would have meant greater operating and maintenance cost. The gas-oil cooler is ideally suited to automatic operation, while it is doubtful if a system using water or air as cooling medium would lend itself to satisfactory unattended operation.

The same type of oil cooler has been applied to a main-line station with comparable results. The paper includes a curve showing effect of suction-gas cooling on horsepower per million cu ft, plotted against compression ratio. This applies to engines having an oil heat load of about 625 Btu per bhphr. Similar curves can be developed for other oil heat loads.

Abstracts from "Aspects of Gas Heat Exchangers as Applied to Transmission System Problems," by F S Young, asst chief engineer, Panhandle Eastern Pipe Line Co. Presented at Natural Gasoline Assn of America's Amarillo-Plains Regional Meeting.

Rapid Test For Calcium Hardness

Similar to the total-hardness test described in January, the calcium-hardness test is simple, fast, accurate. It is based on the work of Dr G Schwarzenbach and associates

By V M MARCY
Hall Laboratories, Inc

► CALCIUM, as well as total hardness in water, can be determined by an easy titration. Principles used (Ref 1 and 2 below) are those Dr G Schwarzenbach announced. Equipment is the same as for the total hardness method (Ref 3); only two reagents in addition to a titrating solution are required. Having tests for both total hardness and calcium hardness makes it possible to figure the magnesium value by simple subtraction.

Method is applicable without special techniques to waters containing as little as 0.5-ppm calcium. Test is rapid and approaches classical volumetric methods in accuracy.

As an aid in distinguishing the endpoint, about 40 ml of the sample may be added to the dish; keep the other 10 ml in reserve. After titrating rapidly to an approximate endpoint, add the remaining 10 ml and titrate slowly to the endpoint.

References:
1. Schwarzenbach, G; Biedermann, W; and Bangerter, F: *Helvetica Chimica Acta, 29*, 811-819 (1946).
2. Schwarzenbach, G; and Gysling, H: *Helvetica Chimica Acta, 32*, 1314-1325 (1949).
3. Marcy, V M: *Power, 94*, pp 105 and 108 (Jan 1950).

TABLE I—REAGENTS* NEEDED

Buffer is strong sodium hydroxide solution to which sodium sulfide is added to minimize interferences.

Indicator is made up by adding stabilized ammonium purpurate to distilled water. As a matter of convenience a standard amount of solid, stabilized ammonium purpurate can be supplied in capsule form. The indicator solution slowly deteriorates but is satisfactory for at least one month after its preparation.

Titrating solution contains a complex-forming sodium salt of ethylene-diamine-tetra-acetic acid. Solutions are available of which 1 ml is equal to 17.1 ppm (1 grain per gal) or to 20 ppm calcium carbonate, based on a 50-ml sample of water.

*Available from Hagan Corporation, Pittsburgh, Pa.

TABLE II—CALCULATIONS FOR THE TEST

Calcium (Ca) and Magnesium (Mg) can be calculated with equations applying to the strength of titrating solution used:

For 17.1 titrating solution, 1 ml = 6.85 ppm Ca = 4.16 ppm Mg
ppm Ca = 6.85 x (burette reading in ml)
ppm Mg = 4.16 x (ml for total hardness — ml for calcium)
For 20 titrating solution, 1 ml = 8 ppm Ca = 4.86 Mg
ppm Ca = 8 x (burette reading in ml)
ppm Mg = 4.86 x (ml for total hardness — ml for calcium)

Procedure:

1 Measure 50 ml of sample into an ordinary laboratory white-porcelain dish. Then add 4 drops of buffer solution to bring pH of the sample to about 12.0

2 Add 1 to 3 drops of ammonium purpurate indicator (murexide). Indicator is a violet-blue color at pH 12.0 in a calcium-free water. If calcium is present the sample turns red by forming a red compound with the indicator. Magnesium content as high as 250 ppm has no effect on this indicator

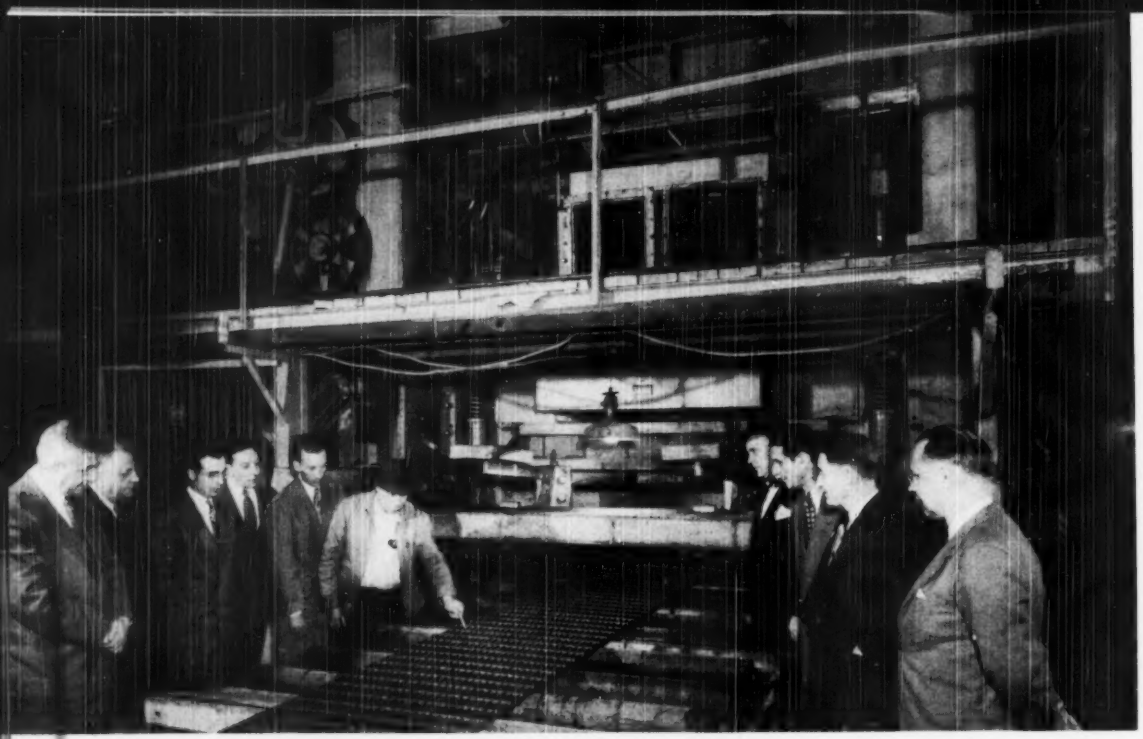
3 Titrate with a standard solution of ethylene - diamine - tetra - acetic acid salt** until the endpoint, a violet-blue color, is reached and no further color change takes place. Titrating solution extracts calcium from the indicator compound causing it to revert to its normal violet-blue color. A colorless complex, formed between the titrating solution and calcium, remains in solution but the calcium in it cannot react

**This material is known under the trade names of Trilon B, Nullapon B, Versene, Versenate, Inthol D, Sequestrene, Water Softener A, and perhaps others.

TABLE III—INFLUENCE OF VARIOUS CONSTITUENTS ADDED TO THE WATER SAMPLE

Concentrations shown permit running a calcium test on water containing 7 ppm calcium (Ca), with an accuracy of ±0.5 ppm.

Constituent	*Concentration, ppm*	*Remarks*
Chloride	8000	Poor endpoint with higher concentrations.
Sulfate	5000	Poor endpoint with higher concentrations.
Nitrate	1000	Higher concentrations may be tolerated but are seldom encountered.
Sulfite	1000	Higher concentrations may be tolerated but are seldom encountered.
Silicate, as SiO_2	1000	Larger concentrations will tend to obscure endpoint.
Carbonate	500	
Magnesium	250	
Aluminum	100	Higher concentrations can be tolerated if more buffer is added.
Chromate	50	Higher concentrations can be tolerated if more indicator is added.
Chlorine	50	Indicator fades rapidly in presence of higher concentrations.
Orthophosphate	50	Sample should be cool and titrated immediately after adding buffer.
Zinc	20	With higher concentrations zinc is partly titrated. More zinc can be tolerated if more buffer is added.
Metaphosphate	15	Poor endpoint results with higher concentrations.
Copper	5	Higher concentrations can be tolerated if more buffer and indicator are added.
Nickel	5	Poor color change with higher concentrations.
Manganese	5	Larger concentrations will tend to obscure endpoint.
Ferrous iron	5	Low results are obtained with higher concentrations.
Ferric iron	3	Low results are obtained with higher concentrations.



1 Multiple weld transformers like this hydraulic press make 80 electric welds under uniform pressure at one time on industrial grating. It sets up so highly specialized a demand on your electrical system that you need planning to meet it

Welding Loads Need Good Power Supply

► MASS PRODUCTION of any item—toasters to automobiles—is impressive. But the only reason a manufacturer resorts to it is to cut down his production costs. The different steps and equipment he uses have to stand the test of, "Does it reduce costs?"

Multiple transformer welding presses, Fig. 1, and, in fact, all resistance welding has met this test. Yet many plants, particularly the small ones, don't get all the benefits possible because there must be an adequate power supply behind the equipment. How do you know what is adequate?

Remember, a good bit of the power-supply system for any industry is within the plant itself. This would include both power-supply transformers and conductors. You can appreciate from this fact that no two power systems are alike, so no rule can be laid down that applies to all plants.

Within the Plant. There is not much you can do about plant location or outside service except live with it. Usually it takes too much money to reduce impedance of the power-supply line and thereby improve voltage regulation. You can, though, consider your own plant setup—inside power supply, welding load demand, voltage drop—for possible reductions in kva load, improvements in the system.

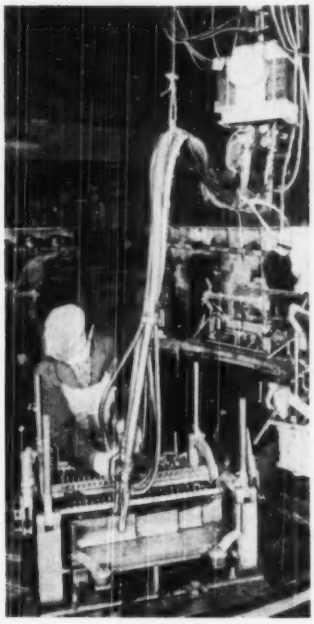
There are four major classes of information you should seek: (1) an estimate of the magnitude, power factor and characteristics of the welding load (2) an estimate of the equivalent continuous thermal load of the welder (3) a determination of voltage regulation required at all points in the plant distribution system to avoid interference (4) a determination of voltage regulation the power company wants, to avoid interference with your neighbors. Your utility will answer this.

1—Begin With Load Demand. How much is it? Size and characteristics of the instantaneous demand load are most important. Capacity of your supply system is determined by the effect of this load on other loads served by either plant-distribution system or the outside power-company system, or both.

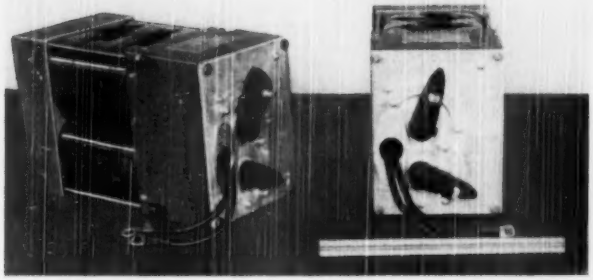
Nameplate rating of the welder transformers won't help to fix welding demand. This is a thermal rating only. Nature of the welding operation and the welder design set the kva demand, Fig. 5, used by one auto manufacturer.

Optimum welding current for each metal thickness is the value this manufacturer found most practical. *The Welding Handbook*, of the American Welding Society, and the *Resistance Welding Manual*, of the Resistance Welder Mfrs Assn, gives the data for other materials.

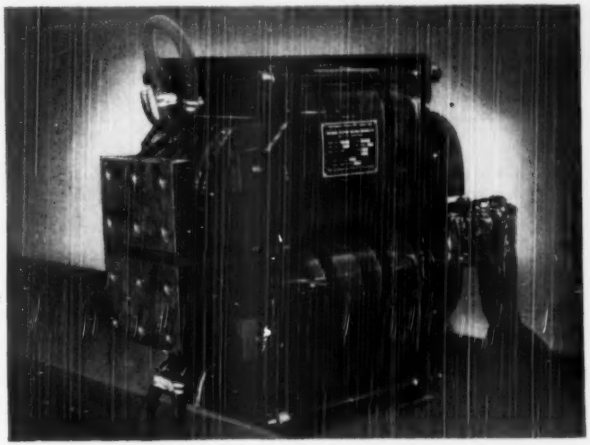
When the auto manufacturer tried to figure out welding-transformer secondary loop impedances he took primary current and voltage readings on a representative number of machines in operation. His figures varied from .000400 to .000700 ohms. Because available space and relative locations of transformers and guns change you can't count on uniform secondary cable lengths, spacing or configuration. Estimating secondary impedances is difficult but the averages in Fig. 6 are close enough for power-supply calculations.



2 Single spot welders don't need close voltage-variation like multiples do



3 Welding transformers carry load for only 50% of the time so you can't fix load demand by their nameplate rating. This is a thermal rating only



4 Special core materials have gone into more recent transformers, above, Fig. 3, to reduce weight and size, not for any electrical advantages

Why limit the benefits you get from resistance welding by a poor electrical supply? Here are the main factors* your system will have to carry

Of recent years a number of welding transformers have been built with special core materials, Fig. 3, 4. But the sole reason, to date, for such special construction has not been for electrical advantage but rather for reduction of weight and of over-all size.

Once you have an idea of the load demand you will have from welding equipment you're ready to check on the load characteristic. With the job above you will have an instantaneous load demand of short duration and a low power factor. For a multiple-transformer welding press, power factor runs 40% lagging.

2—Thermal Load Effect. While instantaneous demand, above, is of prime importance you need to know thermal or heating effect of the welding load to design a good power-supply system. Power transformers, unlike welding transformers, are designed to carry a certain kva load continuously within a specified temperature rise.

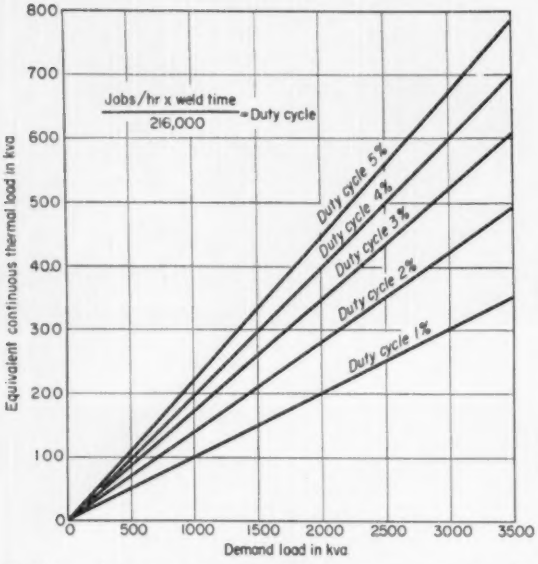
Welding transformers, Fig. 3, 4, on the other hand, are built to carry a certain kva load only 50% of the time, called a 50% duty cycle, within a specified temperature rise. So heating effect of a welding load is a function of kva demand and duty cycle and is known as the equivalent continuous thermal load, or ectl. It is equal to kva demand times the square root of the duty cycle.

3—Voltage Regulation. Drop in voltage at any point in the power-supply circuit depends on the kva load and its impedance at that point. Voltage drop at welder can be as high as 25%, but only if the welding transformers have compensating tap switches and controls supplied from a separate power source. With this arrangement the same drop occurs with each weld. But with several loads coming off the same power supply, permissible voltage drop at any one point depends on the voltage regulation required for other loads at that point.

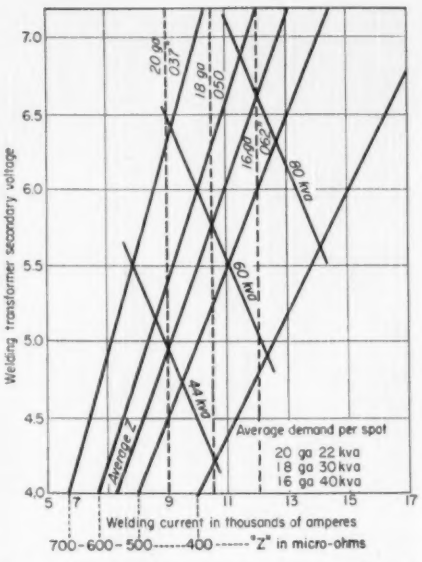
Voltage variation is another entirely different circuit characteristic you'll want to know about. It is the variation in voltage on the bus or feeder at the last branch point feeding a load exclusive of any drop caused by the load being studied. For multiple transformer-welding presses it should be held to -5% if economically possible. Rejects from multiple spot-welded assemblies, Fig. 1, justify a closer voltage variation tolerance than single spot welders, Fig. 2.

Feeder Circuits. When you have assembled all the facts above you are

*Abstracted from a paper, "Power Supply for Multi-Transformer Welding Presses," by T F Ellis, Kaiser-Frazer Corp. Presented before the AIEE and AWS Conference on Electric Welding, Detroit, Mich., April 1950.


Equivalent continuous thermal load in kva
Demand load in kva
Jobs/hr x weld time / 216,000 = Duty cycle
Duty cycle 5%
Duty cycle 4%
Duty cycle 3%
Duty cycle 2%
Duty cycle 1%

5 Nature of the operation and welder design set kva demands. Here is how one auto manufacturer estimates its demand



6 Figuring welding transformer secondary loop impedances is difficult. Averages above are close enough to estimate

ready to plan your power supply. What feeder type you use and its size is shaped pretty much by amount and characteristics of welding load, permissible voltage drop, thermal load, equipment location, plant operating practice and cost.

Voltage drop through the selected feeder circuit can be calculated from standard tables or supplied directly by the feeder manufacturer. Usually any feeder designed to operate within normal voltage-drop tolerances has enough thermal capacity. Single conductor cables in conduit, concentric cable, or low reactance bus duct have worked well with multiple transformer welding presses. But don't go above 750 mcm. The wide interaxial spacing of conductors increases circuit reactance too much.

Because multitransformer welding presses make a large number of welds at the same time, the welding transformers are often connected to give as balanced a 3-phase load as possible. The single-phase transformers are arranged in three groups and then each group connects to a different phase. The reduced kva demand per phase results in less voltage drop in the feeder and the supply transformer. Be careful to hold phase balance to within 10%.

Whether you go to single- or 3-phase firing on a welder requires knowledge of how the welder is designed, capacity and type of power supply, nature of the rest of the plant load. Most welders with six or more transformers to a welder should be designed for 3-phase operation wherever possible. In fact, the high kva demand requirements of multiwelding transformers make 3-phase operation preferable.

Suppose you have a 3-phase supply system and add single-phase welders to just one phase. Voltage drop on the loaded phase would be twice that for the same kva of 3-phase load. You would need a larger 3-phase transformer. With this hookup, regulation would be improved and you could also supply a power load. If a single-phase transformer were used, kva capacity would be less but all you could handle would be the welding load.

Grouping Welders. Since the duty cycle of multitransformer welders is low, about 5%, you can usually group two or more welding presses and feed from a single source without interlocking. The only thing you have to look out for is that voltage variation, resulting from voltage drop produced by another welder operating at the same time, does not get below –5%. Of course, you should check to see what effect the combined voltage drop has on other loads coming off the supply system.

As a rule of thumb if the supply system has enough capacity to maintain voltage-variation tolerance when your two largest welding machines come on together you can feel reasonably sure you're safe. Seldom do weld times coincide exactly during simultaneous operation.

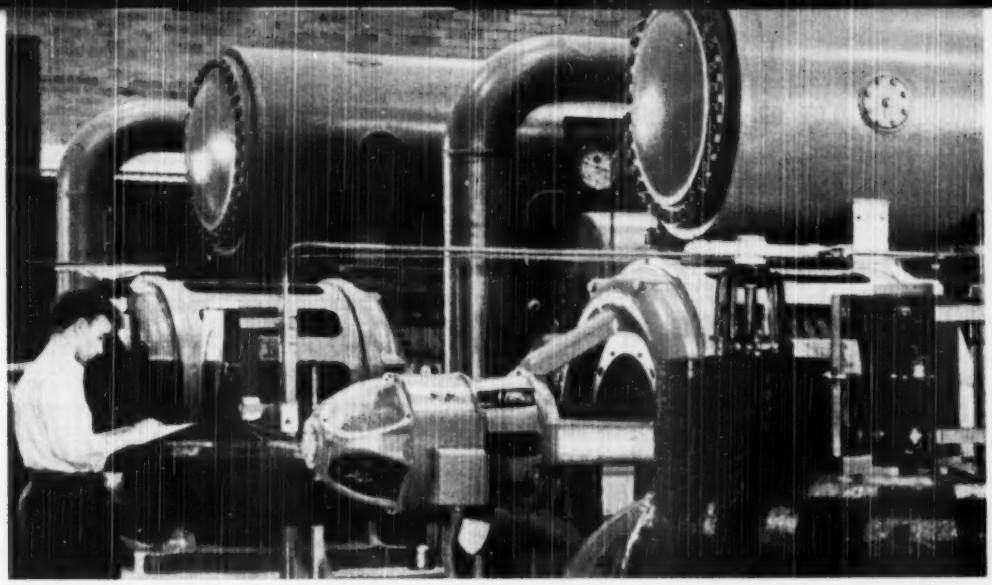
When you serve a group of welders from a single source, be sure thermal capacity is adequate. Thermal load should equal the sum of the equivalent continuous thermal loads of each welder based on individual demand and duty cycle. Actually, it is something different. From information now available you can apply a diversity factor of 40% to the total of individual thermal loads except the largest. You add that at 100% ectl. As more and more larger plants use multitransformer welders thermal load gages like this one will become more accurate.

Other resistance welders served from the same feeder as the multiple transformer ones will operate all right as long as voltage variation stays within –7½% when the large welders come on.

Reducing Kva Load. Greatest reduction in kva demand for multitransformer welding results from power-factor correction. Sometimes just locating transformers so secondary cable spacing gives the least possible inductive reactance will improve power factor noticeably. If needed, transformers with a single secondary can be used so large cable loops won't be required to reach isolated welding guns.

Shunt capacitors at various load

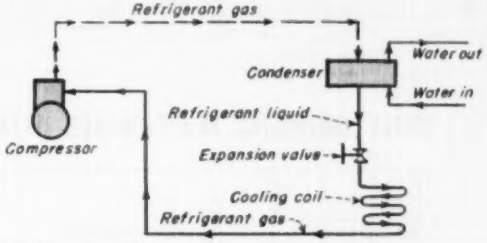
(*Continued on page* 220)



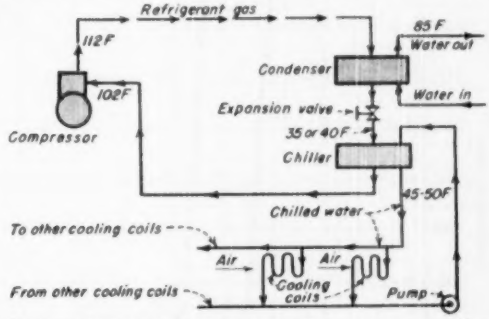
Constant operating checks on installed air-conditioning equipment keep you posted on how well you are meeting design conditions. If you plot performance data against design you can tell ahead of time how your new equipment will perform

You Can Predict Air-Conditioning Results by Graphs

Here's a quick, accurate way to judge how your air-conditioning system is going to work out even before you've put it together. Tyler G Hicks tells how to set up a series of graphs that relate heat loads, latent and sensible, to your compressor, condenser and other equipment



1 Direct-expansion air-conditioning system employs a compressor, a condenser, expansion valve and cooling coil

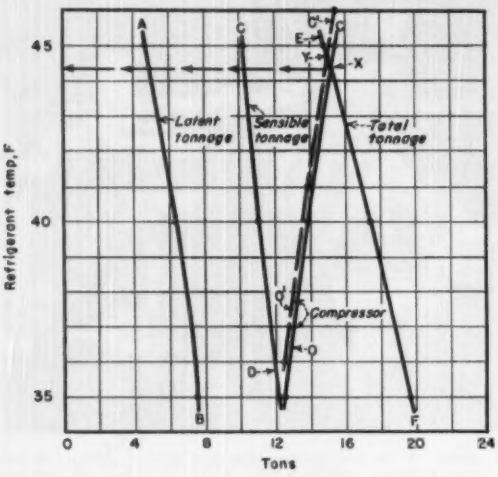


2 More typical, large-sized installation uses many different elements that must be matched to give good results

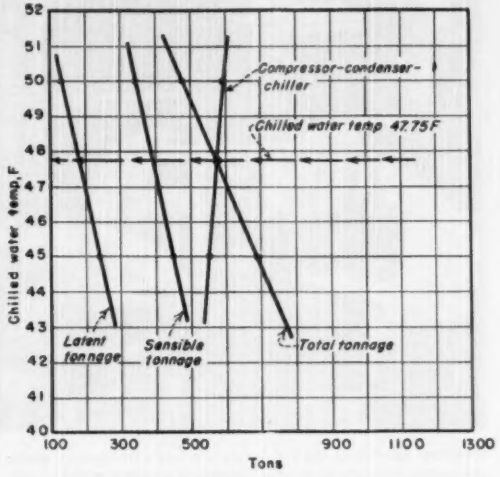
► IN LAYING OUT an air-conditioning system you usually plan it around standard equipment readily available. One important thing you must do is predict where the actual operating points for the equipment will fall. Once you have made this forecast, you can tell if your system will meet the load and safety factor requirements you want.

You can determine any design operating points you choose, and then by a study of performance data of various manufacturers' equipment, match standard equipment on the market against these points. To do it this way calls for some involved calculations. You'll get almost as precise a result by a graphical analysis. This method is usually much faster and accurate enough for all ordinary air-conditioning

COMBINED PLOT OF ALL PRINCIPAL ELEMENTS LOCATES SYSTEM LOAD POINTS...

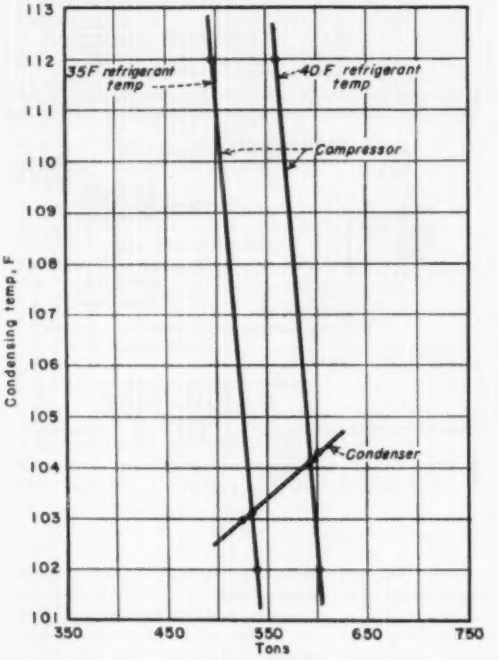


3 Conditioning equipment for simple air-conditioning system, Fig. 1, is plotted to determine system operating points

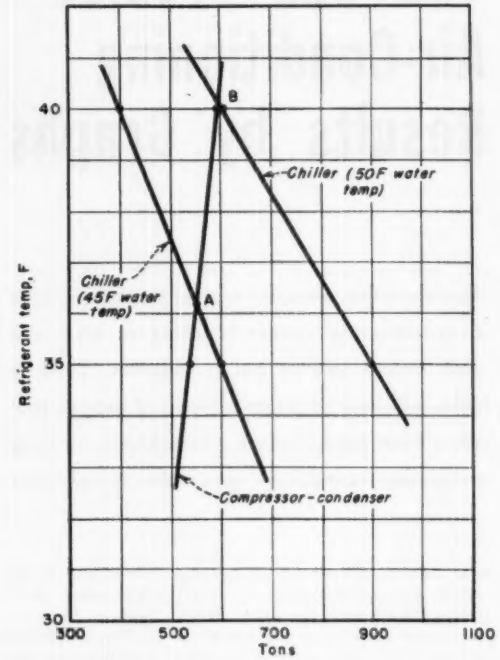


4 More complex chilled-water air-conditioning system requires several steps; then combines data, *above*, for final answer

... WHILE INDIVIDUAL PERFORMANCE DATA SHOW HOW EACH ELEMENT WILL OPERATE



5 First step for the chilled-water system is to plot the performance points for compressor, condenser, and match them



6 Next step pictures the relation of chilled-water service to the combined compressor-condenser. Now transfer to Fig. 4

I—SAMPLE CAPACITIES COMPRESSOR COIL-COMBINATION

Refrigerant temp in cooling coil, F	Compressor capacity, tons	Cooling-coil* capacity tons	
		Latent	Sensible
35	12.5	7.5	12.2
40	13.9	6.3	11.1
45	15.4	4.6	10.2

*Cooling coil is rated to handle 5200 cu ft of air per minute

II—TYPICAL INDUSTRIAL AIR-CONDITIONING EQUIPMENT

Compressor, condensing temp, F	Refrigerant temp, tons		Condenser, 85-F outlet cond temp	
	35 F	40 F	F	Tons
102	539	602	103	525
112	497	561	104.3	600

III—LOAD CONDITIONS, ELEMENTS OF TABLE II SYSTEM

Water-chilling unit			Air-cooling coil load needs		
Refrigerant temp,	Chilled-water temp, tons		Tonnage	Chilled-water temp	
F	45 F	50 F		45 F	50 F
35	600	900	Latent	238	133
40	400	600	Sensible	448	342
			Total	686	476

systems. Let's see how it works on a job.

Compressor and Coil. Suppose you plan a very simple air-conditioning system, Fig. 1, where you combine a compressor and a direct-expansion coil. When you add a bank of filters, this simple arrangement becomes similar to many systems now operating. Let's assume a Freon-12 compressor for this job. The capacities for the compressor and coil elements show in Table I for the selected refrigerant temperature.

When the suction line is compactly mounted, pressure loss in it need not be considered. If you have a long suction line you'll have to take pressure drop into consideration. But use the graphical analysis for both cases just to see how they affect the operating point.

Set up curves by plotting refrigerant temperature in degrees F against refrigerant compressor tonnage. Start out with the compressor capacity and plot it, line *CO* in Fig. 3. Then add cooling coil capacity in terms of latent heat, line *AB*, and sensible heat, line *CD*, and total cooling-capacity requirements, line *EF*, in tons—all from Table I. Total tonnage, of course, equals the sum of the latent and sensible heat needs in tons.

The operating point where the selected standard compressor matches the load conditions is at *X*, the intersection of *CO*, the compressor-capacity curve, and *EF*, the total cooling tonnage of the cooling coils. In our sample case, total tonnage needed at this operating point is 15.2. Latent heat requires 4.9 tons, and sensible heat 10.3 of the total tons. Refrigerant temperature for this size compressor must stay at 44.3 F to handle the load.

But suppose you have a loss of pressure in the suction line of, say, 1 psi? It is customary to allow a temperature loss of about 1 F for each pound loss in pressure in compressor suction piping. So in Fig. 3, compressor-capacity curve gets under way at *O'*, just 1 F above *O*. This 1 F difference holds throughout the length of curve, *O' C'*.

The new balance point, pressure loss considered, is at *Y*. Total tonnage required for the cooling coils becomes 15 tons. Sensible heat uses up 10.2 tons, and latent heat the remaining 4.8 tons. Refrigerant temperature is 44.7 F. But its temperature as it leaves the compressor must be 1 F lower, 43.7 F.

Now that you've made the analysis, how do you put it to work? You can readily compare compressor-capacity rating with the actual operating point to see if you have enough of a safety factor. What's more, now that you know what compressor output's going to be, you can predict some costs. You can compute water and power costs for system operation, for example.

Chilled-Water Cooling. Many air-conditioning systems, certainly the larger ones, have chilled water in the cooling coils rather than refrigerant, as in the direct-expansion method above. Fig. 2 shows a chilled-water circuit. Here the refrigerant expands through a water chiller to lower the temperature of the water passing through the chiller. This chilled or cooling water flows to cooling coils spotted around the system. Air to be cooled is blown over the coils and gives up heat to cool water in the coils.

Once again, you can use standard air-conditioning elements. And you can determine the actual operating point by the graphical method. It's a little more involved but not difficult.

Tables II, III give the sizes and some of the performance points of the equipment pieces you'll select for your example. Refrigerant gas reaches the compressor at 102 F. It rises in temperature during compression to 112 F. Its condensing temperature is, of course, 102 F. Or, to be practical, allow up to 104 F or so. (We took 104.3 F.)

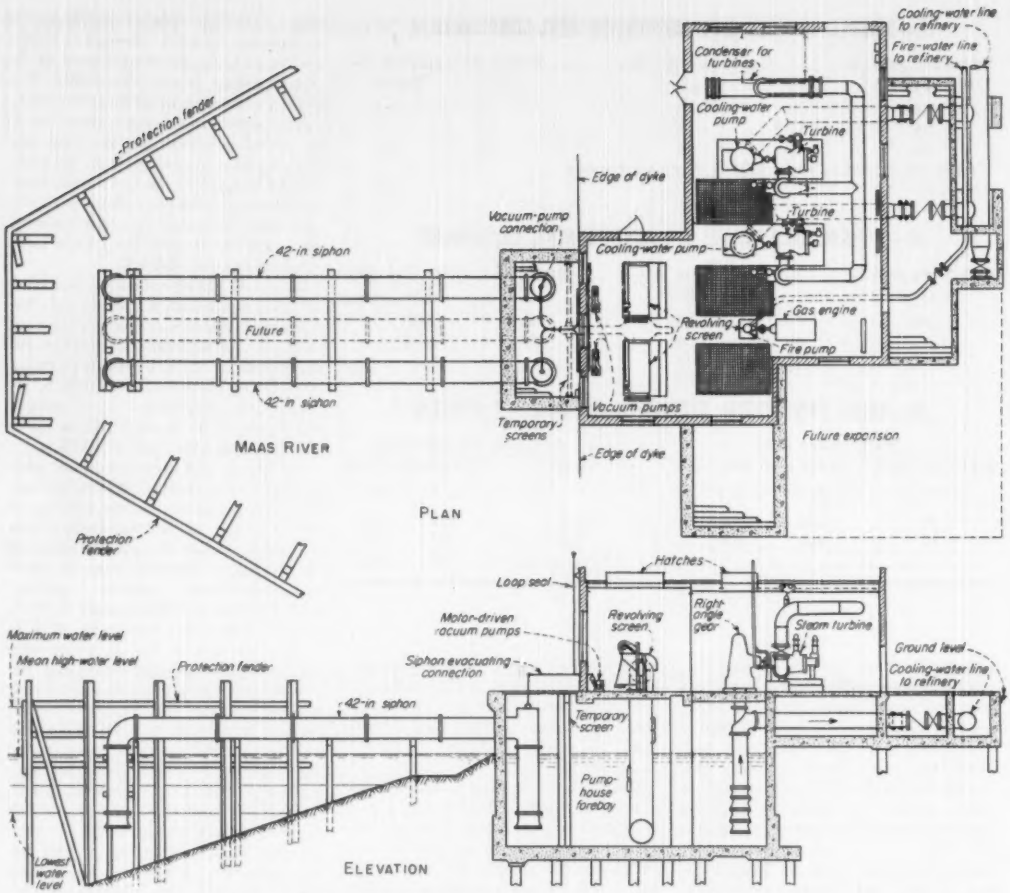
On Fig. 5, plot these points for compressor and condenser. Where the condenser curve meets the two compressor curves at the selected condensing temperatures, Tables II and III, you see the system needs 535 tons of compressor-condenser capacity, working with a refrigerant temperature of 35 F, and 592 tons with a refrigerant at 40 F.

Now go over to Fig. 6, using temperature-ton coordinates and plot the combination compressor and condenser capacities along with the water chiller figures, Tables II and III. Points *A* and *B* give the combined capacities of the three units at chilled-water temperatures of 45 F for *A*, and 50 for *B*.

With the values here of 550 and 596 tons, you have enough data to take the final step back to Fig. 4. This figure helps you determine the capacity for the whole system. The ton requirements that the air-cooler coil puts on the system are represented by figures picked off Table III. You plot these values and latent and sensible heat tonnages, Table III, and find the actual operating point on Fig. 4. Total tonnage curve shows 575 tons total capacity needed, of which 395 is for sensible heat and 180 tons for latent. Chilled-water temperature is 47.75 F.

Going back to Fig. 5, at 575 tons load the condensing temperature was 103.8 F. Refrigerant temperature, shown in Fig. 6, is 38.5 F for this same tonnage. You now have all operating points for a complete system.

Note that Fig. 4 is a curve similar to Fig. 3. The only difference is that chilled water instead of refrigerant is the ordinate. If chilled-water temperature should increase over the 47.75 F point, the cooling-coil capacity would be reduced. Then you would make the same correction for this increase of temperature that you made in Fig. 4 for an increase in pressure loss.



1 Plan and elevation of the cooling-water pumping plant in which are installed two vertical 2-stage 18,000-gpm 120-ft head pumps. They are driven at 800 rpm by 650-hp 3600-rpm steam turbines through right-angle speed-reducing gear units

Pumping Plant Boasts Siphon Intakes

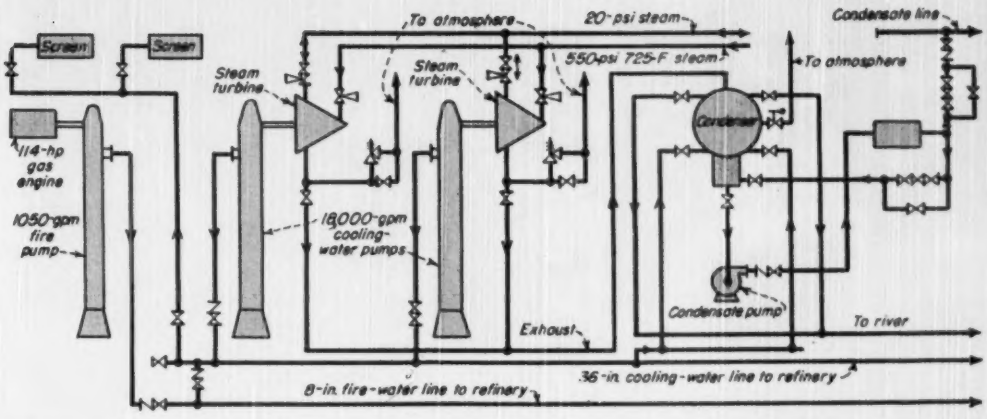
By **C J RUZICKA**, *Chief Utilities & Power Engineer, Calif. Texas Oil Co, Ltd*
and **R R POPHAM**, *Consulting Engineer, Allied Processes*

Cooling-water pumping plant for oil refinery, built on a dyke in Holland, introduced intake problems. They were solved by installing a siphon through which water flows into the pump-suction forebay

► ONE OF EUROPE'S first postwar oil refineries is approaching completion, on the Maas River, near Rotterdam, Holland. This refinery, which is being constructed for Caltex Petroleum Maatschappij, is designed to process 20,000 barrels a day of Near East crude. It will produce gasolines, kerosenes, diesel oil and other fuels. Caltex affiliates will distribute them in Holland, Belgium, Luxembourg, and possibly those areas within Switzerland that are readily reached by boats through the Rhine.

Cooling Water. One of many problems that arose during the design was furnishing the refinery with cooling water. Process cooling requirements and other factors in the over-all design showed a need for about 16,000 gpm of cooling water at 50 psig, pumped from the Maas River.

Two 18,000-gpm vertical high-lift pumps were selected, instead of horizontal ones located in a well because of



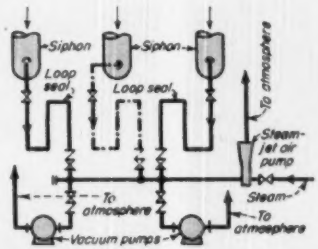
2 Diagram of pump and turbine hookup. Turbines exhaust into 20-psi process line or to surface condenser, or both. Single 1340-sq-ft condenser serves two turbines. Condenser cooling water is taken from refinery line, discharged to river

a maximum tide variation of 17 ft and the resultant high suction lift at low tide. One pump can handle the present refinery load with a slight excess while the other pump acts as a spare.

Steam Supply. Engineering studies favored the purchase of all electrical power, generation of all steam in a refinery boiler plant and steam prime movers for all large drives. Boiler pressure and temperatures were set at 550 psig and 725 F, respectively, for the steam prime movers. Process steam at 150 psi saturated is supplied by waste-heat boilers in the refinery and through reducing valves from the 550-psig header. Low-pressure process needs and prime-mover exhaust were set at 20 psig. This system would vary from an excess to a deficiency because of changing process and seasonal requirements for 20-psig steam.

Based on these considerations, condensing-turbine drivers were selected, operating at 550 psig, 725 F at the throttle with a 20-psig admission or extraction point to balance the refinery low-pressure steam system. To get maximum reliability and flexibility, these turbines are designed to carry full load, from 550 to 20 psig, or from 20 psig to 27½ in. Hg. With this arrangement it was decided that only a single condenser was necessary, Fig. 2.

Pump House. Shown in plan and elevation in Fig. 1, the pump house is on a dyke close to the river to keep the intake distance short. Various types of intakes were considered. An open flume with sheet-piling-retaining walls was studied but found impracticable because of soil conditions. Another type was considered, laying intake conduits in a trench in the river bed near the shore, to keep the conduits below low-water line at all times. It was decided that such a method would tend to deposit silt in the conduits and forebay from where it would be carried over and deposited in the heat-exchanger equipment. Silt removal from the conduits would also be difficult and expensive.



3 Two vacuum pumps and steam air ejector evacuate siphon-intake lines

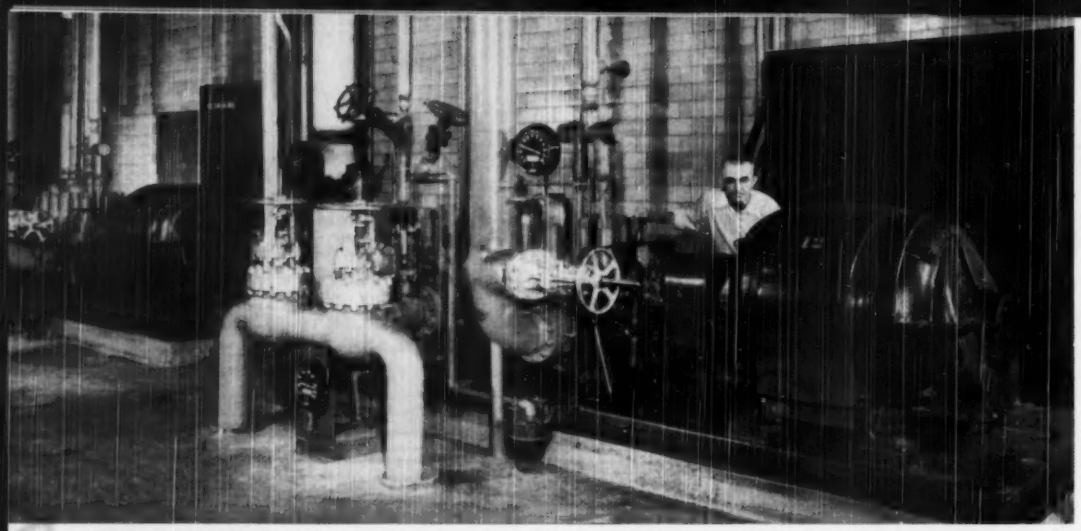
Siphon Intake. To eliminate these objections to a low-level intake, a siphon-intake system was selected. The siphon consists of two 2-in. lines, which take suction in the river about 50 ft offshore, and discharge into the pump-house forebay. Each line carries the entire present cooling-water requirements of the refinery, and space has been provided for a third line when and if needed.

Horizontal part of the siphon intake is supported on piling above mean high-water. It slopes up slightly toward the pump house where an evacuating connection is provided. Two motor-driven vacuum pumps have been installed for constant evacuation. One pump is normally in operation while the other acts as a spare. To aid in starting up and for use in a power failure, a steam-jet air pump is available, Fig. 3. A loop seal prevents water being siphoned through the air-removal lines to the vacuum pumps.

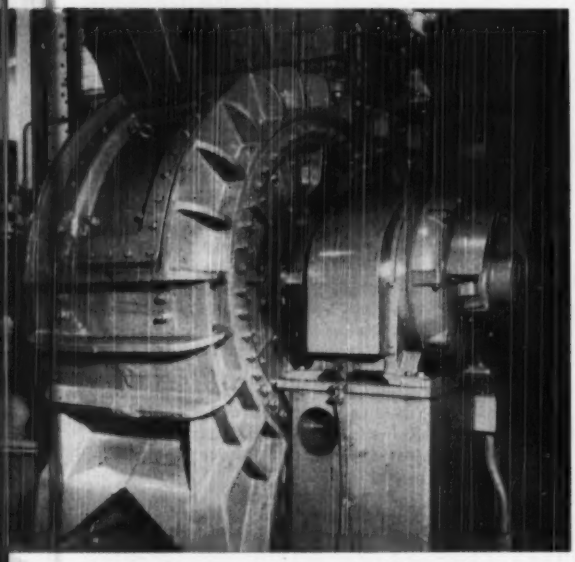
Future Plans. To facilitate future expansion of the cooling-water supply, the forebay was extended beyond the present pump-house structure. Fig. 1 shows that a duplicate installation of the two present pumps can be made to the west of the fire pump simply by removing the west wall and extending the building. All steam headers and the pump discharge header outside the building have been installed with block valves and capped to permit this expansion without shutting down the plant.

Since freezing temperatures may occur in winter, the building over the turbines was extended to shelter the traveling screens. Exposed section of the forebay and the screen inlet bay were covered to seal the pump house. Pumps can be removed through hatches in the plant's roof (see elevation, Fig. 1) by a portable crane.

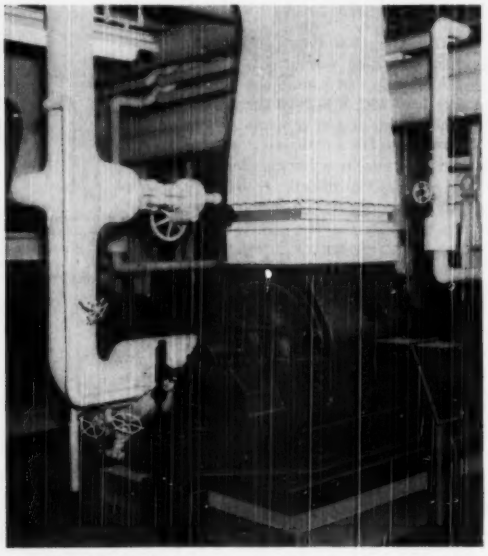
Dependability and provisions for expansion were major considerations in the design. These tended to increase initial plant cost, but since refinery operation cannot be maintained without cooling water, any reasonable expenditure to secure dependability was justified. By the same token, the added cost of provisions for future expansion was relatively minor, compared to the value of production that would be lost if pump-house expansion required a refinery shutdown.



BOILER FEED PUMPS are often installed in areas requiring splashproof motors. Above is typical case. Here two 450-hp splashproof jobs are driving 5-stage high-pressure pumps. Units are installed in Harding Station, Indianapolis, Ind.



DRIPPROOF motor driving coal-pulverizer exhauster. Unit rated 200 hp, 1200 rpm. Note frame grounding-cable in front



AIR-DISCHARGE DUCTS help cool 1000-hp 2400-v 3575-rpm squirrel-cage induction motor for driving boiler feed pumps

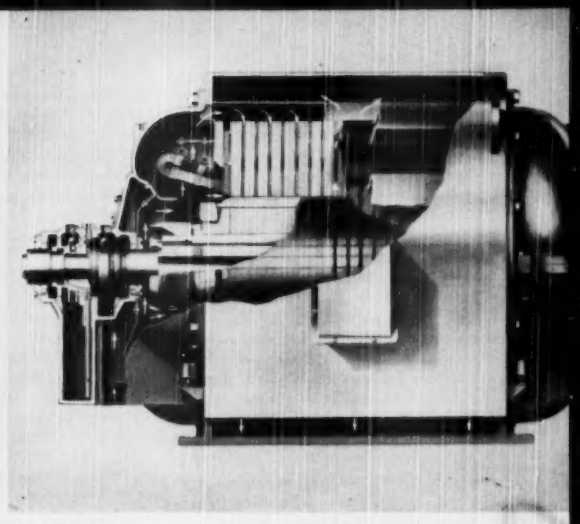
MOTOR SELECTION OF POWER-PLANT AUXILIARY DRIVE HINGES ON MECHANICAL-TYPE PROTECTION: DRIPPROOF, SPLASHPROOF, ENCLOSED. INSULATION, BEARINGS AND MAINTENANCE COME INTO THE PICTURE, TOO

By C D LAWTON, *Application Engineer, Allis-Chalmers Mfg Co*

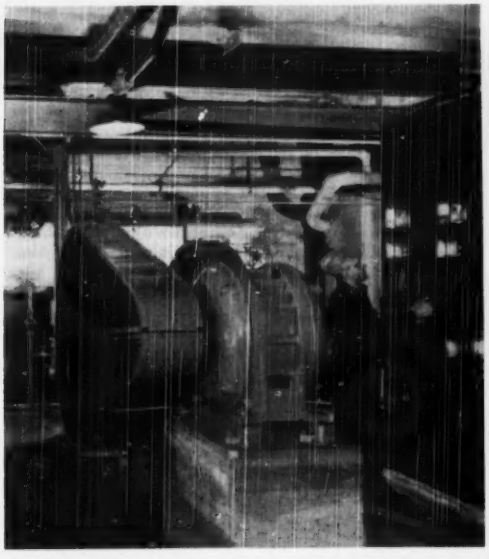
► POWER-PLANT AUXILIARY MOTORS are selected on the basis of reliability and continuity of service. *Down time* must be kept to a minimum. So it follows that squirrel-cage induction motors are widely used since they are the simplest, most rugged and foolproof. Yet wound-rotor motors do come into the picture for variable-speed operation.

From here on we are going to concern ourselves with motor protection, meaning frame enclosures. Now whether you adopt the enclosed or the open

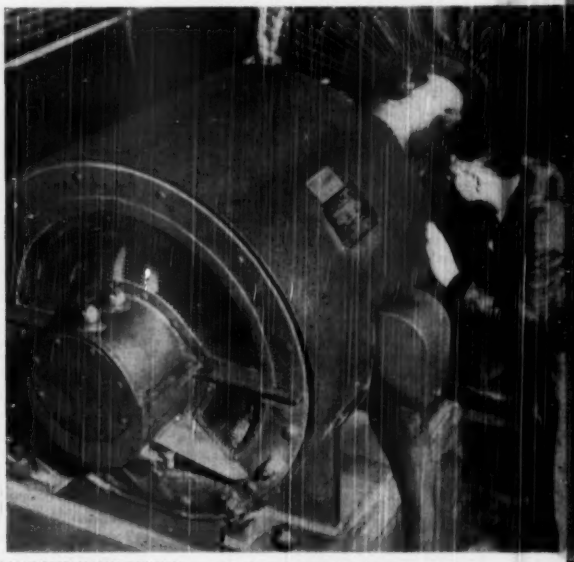
TOTALLY ENCLOSED fan-cooled motors drive induced draft fans located outdoors. They are rated 300 hp 2200 v 705 rpm



SPLASHPROOF type is cut away to show flow of cooling air. Units have baffles at the openings to prevent water entering



OPEN TYPE is OK where water, steam or corrosion problems aren't present. This 75-hp open unit drives air compressor



SILICONE INSULATION permits the winding temperature zooming to 156 C on this over-the-boiler forced-draft-fan drive

type depends largely on motor location, station housekeeping, type of fuel, cost of labor, and plant economics.

Actually, the commonest motor types for auxiliary drives are *dripproof*, *splashproof*, *totally enclosed fan-cooled*, and, for very large motors, *watercooled* and *pipe self-ventilated*. Someone once said electrical engineering is 90% mechanical engineering. This statement certainly holds up here since, electrically, all these motors are the same. Differences lie in mechanical considerations, such as motor enclosures, etc.

Dripproof. These motors are designed so the vent openings won't let drops of liquid or solid particles enter should they fall on the machine at any angle not greater than 15 degrees from the vertical. Dripproof motors are available over the entire general-purpose range of induction motors; that is, 200 hp and less. They are also considered standard for large induction motors, 500 rpm and above.

Hence, the dripproof motor is often used in preference to the older open type, even where the location would allow using an open-type motor. We can say the dripproof unit is perhaps the most commonly used type of enclosure in power-plant application. Except for screened ventilating openings, further protection is usually not required in power plants whose motors are indoors. But further enclosures are needed in the more essential drives, such as boiler feed pumps, draft fans, coal conditioners, circulating-water pump

drives, and in locations where there might be danger of coal-dust explosion, or in dirty atmospheres.

Splashproof. This type enclosure provides greater protection than dripproof construction although the windings, etc, are still exposed to the atmosphere. We can define it as an open machine whose ventilating openings keep out drops of liquid falling on the machine, or coming toward it in a straight line at any angle not greater than 100 deg from the vertical. Power plants often have splashproof motors for outdoor service.

Totally Enclosed Fan-Cooled. Because of tough operating conditions today's trend is toward larger use of totally enclosed motors of the fancooled and watercooled types. Even for indoor service, *TEFC* motors are often preferred in dirty locations and where there is danger of heavy steam leaks.

TEFC type of construction reduces outages and costly breakdowns by keeping flyash, dirt and live steam out of the motor. On top of that, it is also possible to clean, if necessary, some of the newer types of totally enclosed, fan-cooled motors while they are operating. This further reduces down time. Another trend is the placing of many of the more important auxiliaries outdoors. And this has been justified because of high building costs, along with motors now being able to withstand this type of service.

Watercooled. When room or ambient temperatures are abnormally high, special motor construction is often needed. Motors can be equipped with air to water heat exchangers in a recirculating venting system. These systems are used primarily with larger equipment for draft fans and boiler feed-pump services. This type motor is totally enclosed and, in effect, watercooled. Distinct advantages are that the water carries away the heat, and no dirt can enter to shorten stator-winding life.

Some locations for larger auxiliary drives are such that it is harmful to have the warm air discharged into the powerhouse. In that case, a duct may be attached to the air outlet of a motor and the warm air discharged outdoors. For that matter, it can be shunted to another portion of the building where warm air is not detrimental. This type of ventilation is being used to advantage in southern climates and also in some of the newer power plants of modern closed construction.

Insulation. One of three types of stator-winding insulation is generally used. First there's Class A—cotton, silk, paper etc—specially treated for power-plant service. Then we have Class B—mica, asbestos, glass, or a combination of these. Class H insulation brings the new silicones into the picture. To guard further against electrical breakdown after the motor is completely wound, the entire stator is dipped in insulating varnish and baked. This is done at least twice. The process allows varnish penetration to regions unavailable to brushes or spray guns. Hence the core and stator windings are completely sealed for longer life.

Temperature limit for Class A insulation is 90 deg. C observable. This is usually measured by thermometer on the stator-coil ends. In an ambient temperature of 40 C, a 40-C-rise motor allows a 15% overload or service factor. This permits a further temperature rise of about 10 C.

Where ambient temperatures are quite high, in the neighborhood of 50 to 70 deg C, it is desirable to use Class B insulated motors. This class of insulation has a maximum observable temperature limitation of 110 C. This means with a 40-C-rise motor, it is possible to operate in 70-C ambient. If you want to use the service factor for overload conditions, it is best to stay within a 60-C ambient to benefit by the 10-deg margin for service factor. Class B insulation, when applied to a 40-C-rise motor, does not increase or decrease its frame size. But if a 60- or 70-deg rating is used with a Class B insulated machine, the motor frame size is smaller.

Silicone insulation is used for extremely high ambient temperatures. The limiting observable temperature by thermometer for the commoner type of silicone insulation is 140 C. This corresponds roughly to the limiting "hottest-spot" temperature of 180 C. Any combination of rise and ambient may be used to reach this maximum.

Advantages of using silicone insulation include smaller size and lower weight. But the designer has his troubles where there is maximum torque, and where severe voltage fluctuations occur, the motor's maximum or pull-out torque is of importance. To benefit from the service factor in a silicone insulated machine, it is necessary to keep the temperature rise not over 90 C in a 40-C ambient temperature. This allows about 10 deg below the 140 C ultimate to be utilized as a service factor.

In general, insulation life is lengthened by operating at a relatively low temperature. A rule of thumb can be applied to the life of motor windings: For every six or seven degrees that the running temperature of the winding exceeds maximum insulation limit, remaining life is reduced 50%.

Bearings. Power-plant operators, except on small motors, have a definite preference for sleeve-type bearings. They feel an antifriction bearing often fails without warning, while a sleeve bearing gives a tip far enough in advance for the trouble to be taken care of without seriously affecting power-plant operation.

Actually, grease-lubricated antifriction bearings require less maintenance than do the sleeve bearings. And if properly assembled, they can give many years of long uninterrupted service.

Oil leakage is claimed to be one of the disadvantages of sleeve bearings. But if the bearings are properly assembled and adjusted so air pressure is equalized within the bearing there should be no oil leakage.

Maintenance. In any power plant, maintenance is a considerable item. This expense, together with the cost of housekeeping and need for service continuity dictates the extent to which motor protection and enclosures are necessary. But there is a definite trend toward the use of the totally enclosed fan-cooled motor for power-plant auxiliaries.

While on the subject of maintenance, remember that it is desirable to have screens over all air-intake openings. This prevents rags, papers and other material from being drawn into the motors. Such foreign material can plug up the ventilating ducts and cause overheating. On top of that, motors near aisles and in working areas should be completely enclosed with guard screens to prevent workmen from accidentally poking ends of pipes or tools into them.

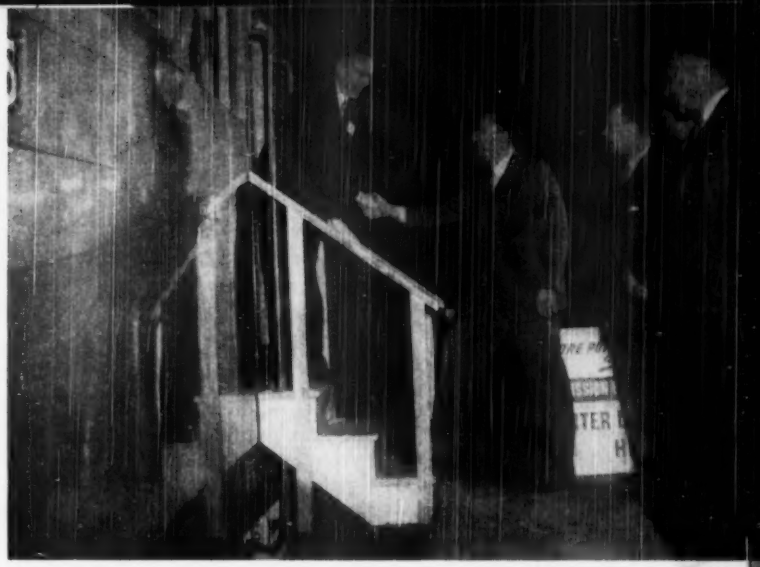
On high-speed motors, papers, rags or other materials may stick on the outside of air-intake screens. This not only interferes with motor ventilation, but the resulting negative air pressure can cause the bearing oil to be drawn out and spread over the stator winding and other inside parts. Hence, air-intake screens must be kept clean.

Another important consideration is to provide some means of keeping motors warm during shutdown periods in spots where moisture is liable to condense on the windings. This may be done by circulating currents through the stator winding or, more commonly, by use of space heaters. Condensation on stator windings, when combined with flyash and dirt, soon harms the insulation. Good maintenance and housekeeping procedures are also good safety habits.

Protection of rotating machinery can be looked on as an economic problem throughout. Ultimate value of adequate protection depends on the evaluation of such things as continuity of service, insurance rates, safety regulations, legal requirements and, most important, protection of life and limb. Appropriate protection pays dividends in reduced over-all cost. A study of these problems is certainly very much worth while.

'It's a Power Show On Wheels'...

. . . says Assistant Editor Jim O'Connor after trip through General Electric's new 10-car *'More Power to America Special.'* Here's thumbnail sketch of what he saw, and you may see when train visits your city

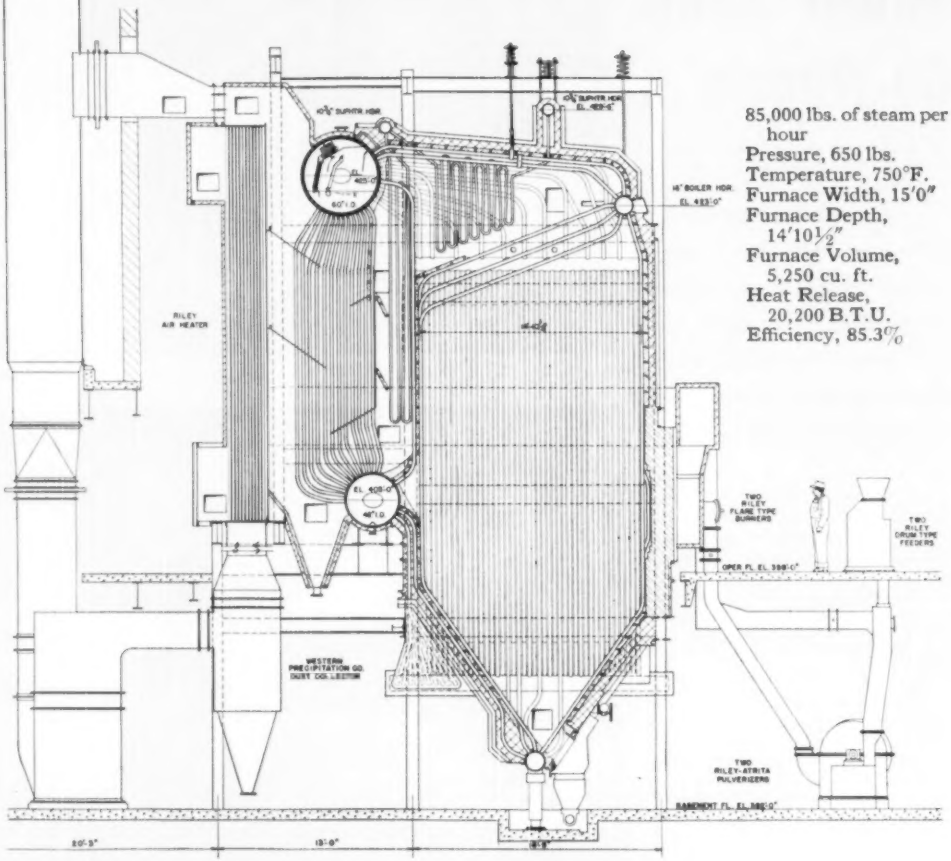


1 **STEPPING ABOARD** biggest electrical display kit ever built *(top)*, Jim's welcomed by C P Fisher Jr, manager of GE's Apparatus Exhibit Train Div. Almost one-quarter mile long, silvery streamliner is chock-full of exhibits of more than 2000 modern electrical products, systems and techniques. *Special* is now on way from New York over first lap of a nationwide tour. Plan is to visit about 150 key industrial centers during '50 and '51. At each stop the train will be inspected by invited representatives of electric utilities, industrials and government agencies. Train will not be open to the general public during tour

2 **STEAM-TURBINE** exhibit catches Jim's eye and finger. Button pressing will light up the major design and operating features on the blackboard. Shiny cutaway models will make the gadgeteer's mouth water. But there's a long road ahead so O'Connor steps across the aisle to the . . .

3 **GAS TURBINE** set up with its innards carefully laid out before a group of application photos. Some design wrinkle in the combustion chamber temporarily stops our roving editor from tinkering with the latest in . . . *(Turn to page 108)*

Brantly Steam Station - Danville, Va.


RILEY AIR HEATER
TWO RILEY FLARE TYPE BURNERS
TWO RILEY DRUM TYPE FEEDERS
WESTERN PRECIPITATION CO. DUST COLLECTOR
TWO RILEY-ATRITA PULVERIZERS

85,000 lbs. of steam per hour
Pressure, 650 lbs.
Temperature, 750°F.
Furnace Width, 15′0″
Furnace Depth, 14′10½″
Furnace Volume, 5,250 cu. ft.
Heat Release, 20,200 B.T.U.
Efficiency, 85.3%

- 85,000 lbs./hr. Riley Steam Generating Unit—550 lbs. 750°F.

BRANTLY STEAM STATION
CITY OF DANVILLE, VA.

Chas. T. Main, Inc., *Consulting Engineers*

Built under the Auspices of
MAYOR EVERETT E. CARTER — M. R. D. BROWN, *Pres. City Council*
E. M. HAWKINS, JR., *Mgr. of Utilities* — B. G. ADKINS, *Supt. Elec. Dept.*

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Atlanta New Orleans Memphis St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · FLUE GAS SCRUBBERS

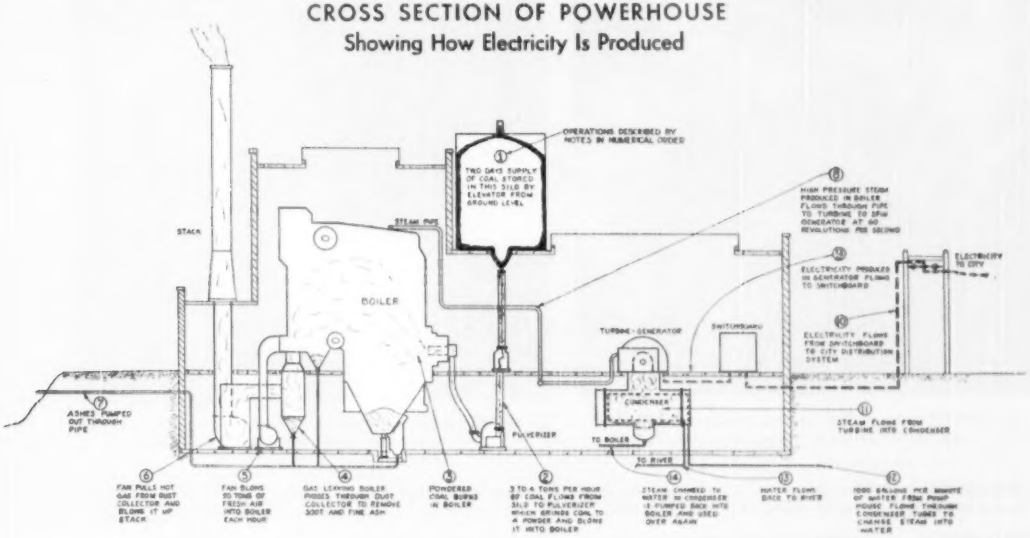
A Fine Example of Good Engineering

The new Brantly Steam Station of the City of Danville, Va., recently placed into operation, is a modern, efficient, well-engineered 7,500 K. W. plant, designed to be expanded ultimately to three units. The Riley pulverized coal fired 85,000 lbs./hr. steam generating unit and the generator are located in the same room with the control panel between them as illustrated below.

Like at so many of the more efficient plants today, whether large or small, steam is reliably and economically generated with a Riley Steam Generating Unit, in this case pulverized coal fired by Riley pulverizers and burners. The single header water-cooled hopper bottom Riley unit was selected because it assured efficient trouble-free operation and because its unique hopper design not only reduced the required building height and cost, but eliminated the cost of a separate ash hopper.

While the initial investment savings resulting from the installation of the Riley single header hopper bottom unit are obvious, you have to see this unit in operation to fully appreciate its performance and construction characteristics. Why not visit a Riley installation when you are considering the installation of steam generating equipment. You will then know why so many engineers select Riley as their first choice.

CROSS SECTION OF POWERHOUSE
Showing How Electricity Is Produced


OPERATIONS DESCRIBED BY NOTES IN NUMERICAL ORDER
TWO DAYS SUPPLY OF COAL STORED IN THIS SILO BY ELEVATOR FROM GROUND LEVEL
STACK
STEAM PIPE
BOILER
HIGH PRESSURE STEAM PRODUCED IN BOILER FLOWS THROUGH PIPE TO TURBINE TO SPIN GENERATOR AT 60 REVOLUTIONS PER SECOND
ELECTRICITY PRODUCED IN GENERATOR FLOWS TO SWITCHBOARD
ELECTRICITY TO CITY
TURBINE-GENERATOR
SWITCHBOARD
ELECTRICITY FLOWS FROM SWITCHBOARD TO CITY DISTRIBUTION SYSTEM
CONDENSER
STEAM FLOWS FROM TURBINE INTO CONDENSER
ASHES PUMPED OUT THROUGH PIPE
PULVERIZER
TO BOILER
TO RIVER
FAN PULLS HOT GAS FROM DUST COLLECTOR AND BLOWS IT UP STACK
FAN BLOWS 50 TONS OF FRESH AIR INTO BOILER EACH HOUR
GAS LEAVING BOILER PASSES THROUGH DUST COLLECTOR TO REMOVE SOOT AND FINE ASH
POWDERED COAL BURNS IN BOILER
3 TO 6 TONS PER HOUR OF COAL FLOWS FROM SILO TO PULVERIZER WHICH GRINDS COAL TO A POWDER AND BLOWS IT INTO BOILER
STEAM CHANGED TO WATER IN CONDENSER IS PUMPED BACK INTO BOILER AND USED OVER AGAIN
WATER FLOWS BACK TO RIVER
1000 GALLONS PER MINUTE OF WATER FROM PUMP HOUSE FLOWS THROUGH CONDENSER TUBES TO CHANGE STEAM INTO WATER

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

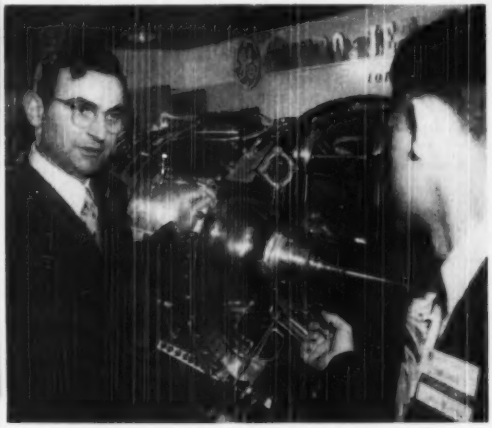
. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS · WATER-COOLED FURNACES · STEEL-CLAD INSULATED SETTINGS · AIR HEATERS

More About Power Show on Wheels

4 **SUPERVISORY CONTROL.** It's connected to a few mock circuit breakers: bells ring, lights flash. Then Jim's off to . . .

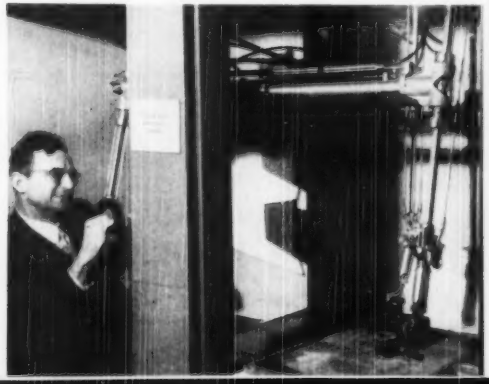
5 **TEST MUSCLE POWER** on hand-cranked generator. Best O'Connor does is 52 watts . . . no cigar! So to full-sized . . .



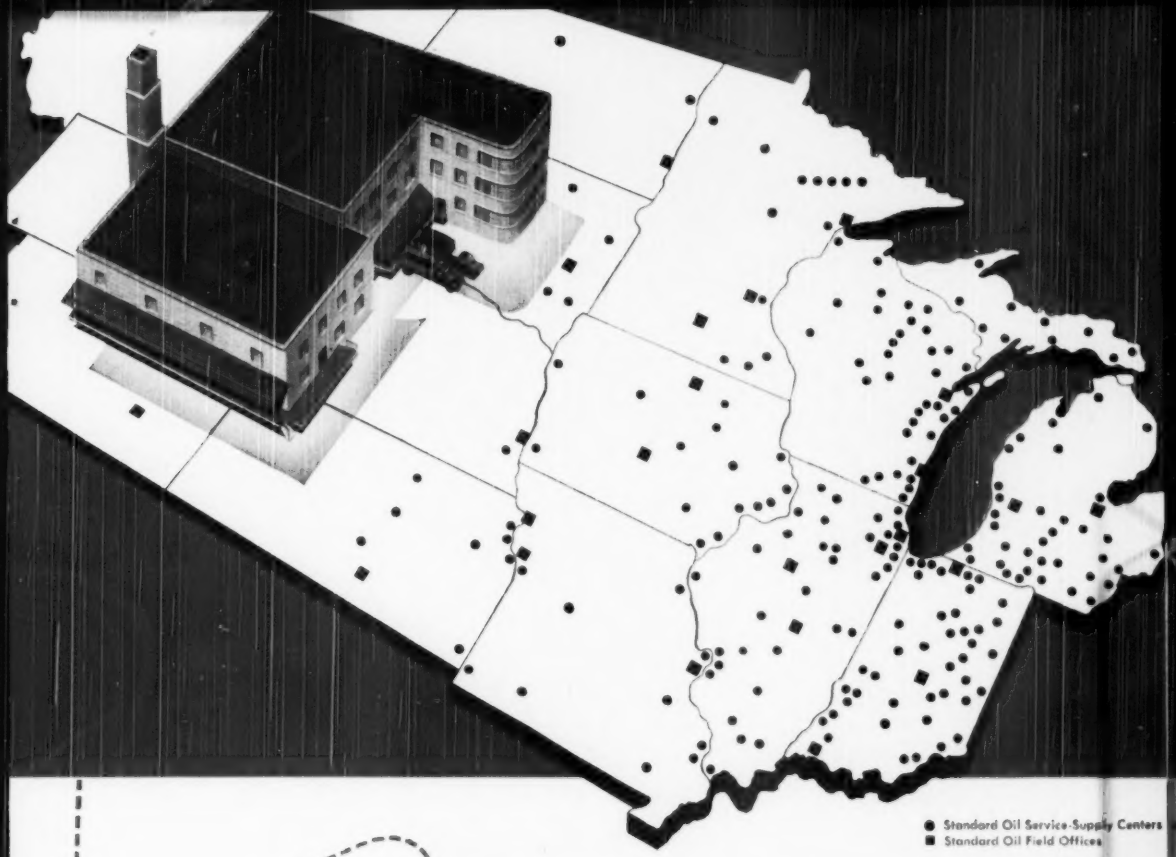
6 **JET ENGINE** next in line. Young engineer-guide is right there with all the answers. After that there's the . . .

7 **SMOKE-DENSITY CONTROL** rig with an operating model of a typical smokestack peeking in at left. Then the . . .

8 **MECHANICAL HANDS** developed by GE for handling dangerous radioactive materials safely. Jim pauses in the . . .



9 **TRAIN LOUNGE.** It's a suitable spot to think over this stimulus to our national economy and industrial well-being



Right in your own back yard!

● If your plant is in the Midwest, you can benefit from a service-distribution set-up that is unique in the oil industry—there's a Standard Oil office and warehouse practically right in your own back yard. The nearness of that service-supply center holds important advantages for you.

Faster Deliveries. You needn't worry about production delays caused by late shipments of necessary lubricants and fuels. You can avoid the expense and trouble of stocking large quantities of lubricants and fuels within your plant.

A Complete Supply. Every lubricant and fuel necessary to the efficient operation of your plant will be carried in the warehouse at your nearby Standard Oil service-supply center. You can always get the product you need *when* you need it.

On-the-Spot Engineering Service. Your nearby Standard Oil service-supply center is headquarters for a Standard Oil Lubrication Specialist who is assigned to your plant. He is close at hand to give you help when you need it. He has plenty of practical experience. He has been specially trained for his job in a Standard Oil Lubrication Engineering School. He is backed by Standard Oil's extensive research and technical facilities.

To arrange for his visit, phone your nearby Standard Oil service-supply center or write to: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

3 IMPORTANT ADVANTAGES

Standard Oil's Lubrication Service is especially geared to serve your midwest operations.

1 Service-supply points are near your plant. You are assured of fast deliveries, prompt lubrication engineering service.

2 Lubrication specialists have been specifically trained in Standard Oil Lubrication Engineering Schools to help you obtain the maximum benefits from lubricants and fuels.

3 Research and technical facilities are geared to help solve your specific lubrication problems.

STANDARD OIL COMPANY (INDIANA)

STANDARD

What's YOUR problem?

R. L. Jenkins, lubricating specialist at Standard Oil's South Bend office solved this customer's problem because he was thoroughly familiar with job requirements and the application of his Stanorust line.

● There is a corps of such lubricating specialists throughout the Midwest, trained and experienced to help plant operators solve similar problems. Experience enables these men to find quickly the cause of lubricating troubles. Knowledge of petroleum products enables them to prescribe the lubricant needed. There is one of these lubricating specialists at the Standard Oil Company (Indiana) office near you. He is there to serve you. A call or a card will put him at your service.

Investigate the cost-saving possibilities of these lubricants.

STANOIL INDUSTRIAL OILS—for cleaner hydraulic systems, gear cases, compressors, and circulating systems.

CALUMET VISCOUS LUBRICANTS—adhere to open gears and chain drives without throw-off. Easy to apply. No heating.

STANOLITH GREASE—withstands high temperatures and resists washing by water.

THE SHOP FOREMAN of Hart Pressed Steel Corp., Elkhart, Indiana, exposes the clean metal surface beneath a coating of STANORUST 1-XC Rust Preventive by a simple wiping operation. The die shown has been protected against rust under severe outdoor conditions for over a year by STANORUST 1-XC.

How to prevent rust under severe outdoor storage . . .

RAIN, snow, heat, cold—plus coal soot from passing locomotives—could be expected to produce serious rust troubles in outside storage. The elements did, indeed, cause difficulties for the Hart Pressed Steel Corp., Elkhart, Indiana, which owns the truck and trailer dies shown above. Despite coatings of heavy oil, rusting was so severe that cleaning a die required at least three hours.

The problem was laid before a Standard Oil lubrication specialist. He pointed out that, to withstand severe outdoor exposure, a rust preventive with special qualities is needed. At his suggestion, the dies were coated with STANORUST 1-XC, a rust preventive especially developed for severe outdoor service.

Use of a STANORUST Rust Preventive has made savings for this company. Many of the dies have been exposed to the weather for over a year, yet STANORUST has kept them completely protected against rust. A die can now be cleaned and returned to service in a matter of ten minutes, as compared with the three hours previously required.

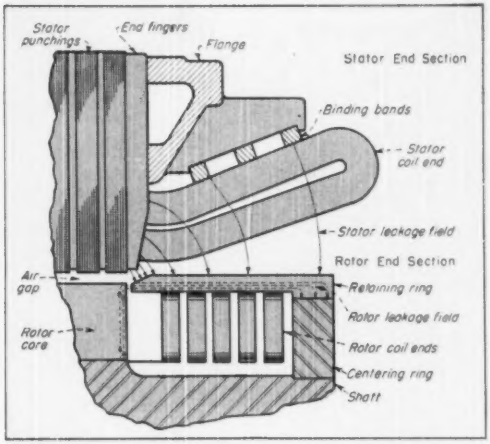
The new and improved STANORUSTS can mean big savings for you through more economical applications, better rust protection. There's a lubrication specialist near you who can help you get the most economical results. How you can obtain his services is described at left. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANORUST
REG. U. S. PAT. OFF.
RUST PREVENTIVES

STANDARD OIL COMPANY (INDIANA) STANDARD

LETTERS FROM A TURBINE SPECIALIST—11

By C A LILLY, Jr and J M LYONS, *Turbine Divisions, General Electric Co*



CRITICAL HEATING POINTS in turbine-generator exist at the inner tips of end fingers and on outer faces of punching teeth

DANGER! Watch Leading Power-Factor Operation

Turbine Specialist
District Office
Dear Mr Specialist

From time to time I hear that leading power-factor operation may injure the generator by end heating. Several of us have been discussing this, and not one knows the cause of the heating. We can't see why there is a problem as long as the generator kva rating is not exceeded. Particularly puzzling is the fact that the field current is lower than when operating at lagging pf.

I would appreciate your telling me what it's all about in terms that are not too technical.

Very truly yours
ENGINEER

Dear Mr Engineer

I don't wonder you're puzzled by limitations put on leading pf operation because of "end heating." It's a rather tricky problem and important to understand so you won't damage your generators without realizing it.

There are *two* kinds of heating in a generator caused by currents flowing through it. The first is the well-known heating of the windings, both stator and rotor. Currents flowing through the resistance of the coils of wire cause this. This heating is easy to control and measure.

Unfortunately, the other kind is not easily recognized or measured. This is the heating of structural metallic parts of the generator adjacent to the stator winding. This is caused by ac flowing in the winding.

Here's what happens. Ac in the stator coils sets up alternating magnetic fields around each coil. These do no harm if they just pass through air or nonmetallic parts. But when they cross nearby metallic members, they set up local "eddy" currents in those parts by induction, as in a transformer. When these currents encounter electrical resistance of members, heating results just as in main windings.

Trouble arises when eddy currents become highly concentrated in some relatively small member and really make it hot—even though rest of machine is relatively cool.

In turbine-generators this action can easily take place on the ends of the stator core. Sketch shows cross section of ends of typical generator. Ac in end portions of stator coils (beyond ends of core) causes stray magnetic fields to be set up, as shown. These leakage fields appear to travel around the machine at same speed as rotor (say 3600 rpm). In so doing, they sweep by the stationary parts of the stator end structure, comprising the clamping fingers, flanges, binding bands and end faces of the punchings. Eddy currents are induced in all these parts to varying degrees, causing heating. This heating can become very pronounced and even dangerous on inner tips of end fingers and on outer faces of punching teeth. *This heating limits operation of generator at leading pf.*

Why is this heating worse at leading pf than at lagging pf? Let's refer to the sketch. Notice that the steel retaining ring over ends of rotor coils provides a nice path for leakage fields to pass through, if this ring is of the usual magnetic steel. Retaining ring also forms a path for leakage fields set up by dc in the rotor. At high rotor current (corresponding to operation at 0.8 pf lagging or lower) retaining ring is strongly magnetized by rotor leakage field and so can carry only a small amount of leakage from the stator. As the pf swings up to unity and over into the leading region, the dc rotor current takes a nose dive. For example, at 0.8 pf leading it is only about one half as much as at 0.8 pf lagging (at full kva). Then the retaining ring becomes very receptive to stator leakage fields and heating in end fingers and punchings becomes dangerous.

All modern turbine-generators are designed to carry full kva at unity pf. This may not be true of all old units in service. End heating troubles may occur when operating even at high lagging or unity pf on these units.

Using nonmagnetic retaining rings reduces end heating. They present a much greater obstacle to passage of stator leakage fields and their magnetic properties are not affected by variations in rotor current. Their inherently lower physical strength, however, restricts their use at present to generators with relatively small rotor diameters. Nonmagnetic steel end fingers and coil binding bands also help reduce end heating. But remember that although a generator with nonmagnetic retaining rings can carry increased kva at leading pf because of reduced end heating, this capability eventually reaches a new limit set by the over-all stability of the generator on its power system.

I hope this little story tells what "it's all about." Now you won't try to burn up your generator by operating at full kva rating at leading pf—unless, of course, your machine is designed for that kind of service.

Sincerely yours
TURBINE SPECIALIST

Note: Through a manuscript omission the name of J. L. Morgan did not appear as coauthor of No. 10 in this series in the April 1950 issue.

Supervisory Control System Teams Elevators To Traffic Needs

To serve the widely varying needs of passenger traffic in off-peak, up-peak and down-peak periods, elevators are dispatched automatically. Idle cars, useless car travel and uneven services are eliminated. Also, passengers' waiting time at each floor is reduced

1 Shamrock Hotel, Houston, has six elevators, operating at 700 feet per minute, under automatic supervisory control

► REGARDLESS OF THE building's type, elevator traffic varies widely at different hours of the day. And so the dispatcher has difficulty regulating operations to give equal service to all floors. To overcome this long-recognized problem, elevator engineers have developed several signal systems that help the dispatcher render better service from a given number of elevators. Only comparatively recently have their efforts produced supervisory-control systems that automatically dispatch a bank of elevators according to traffic needs.

Service Needs. Service demands on a bank of elevators occur in waves rather than in a steady flow, Fig. 5. With variations, these demands can be classified as: (1) Up-peak period, when traffic is largely incoming, as in the morning when people come to work. (2) Off-peak demand, a long period of 2-way traffic with several up-and-down peaks, some relatively severe. (3) Down-peak condition, when traffic is mostly down as people hurry out of the building at closing time.

Supervisory System. One of the supervisory systems, which make it possible to operate a bank of elevators at high efficiency for every traffic condition, is known as a Selectomatic by Westinghouse. It can be applied to any bank having four passenger elevators or more.

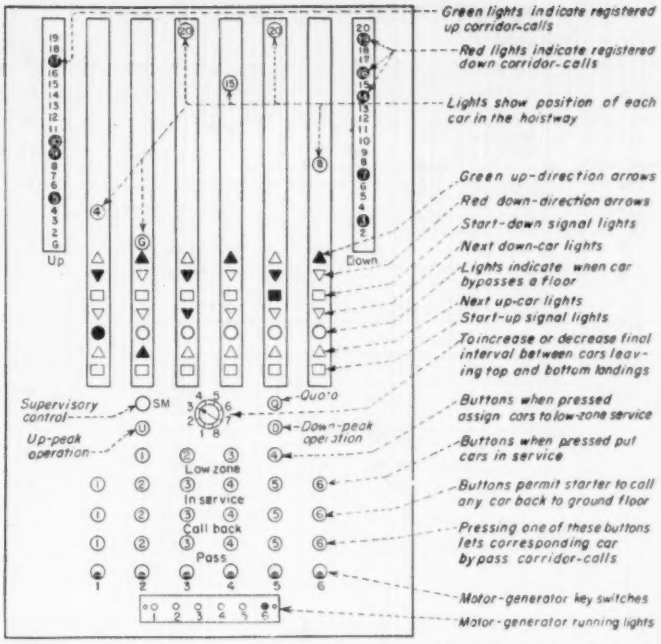
To put into effect the proper system of supervisory control for any traffic condition, the dispatcher simply presses a button. Pressing one button brings elevators into operation to handle up-peak service. Another button schedules elevators to serve down-peak traffic. If neither button is in use, elevators function for 2-way traffic, including peaks.

Dispatcher Panel. At the starter's station on the ground floor is a panel, Fig. 1 and 2, through which the several supervisory operations are initiated. At top center of panel (Fig. 2) are columns of illuminated numbers that show the position of each car in the hoistway. The column on each side shows the registered up-and-down corridor calls. Just below the car-position lights and running from right to left, are rows of lights indicating travel direction of each car and other supervisory signals and the bypass light for each car.

Just below these lights is the *SM* button, which when pressed puts the supervisory system in operation and the *Q* button, which increases by one the established corridor-call quota of the low-rise cars. Between these two buttons is a knob to increase or decrease the established dispatching interval between cars at the terminal floors as they are put in or taken out of service. *U* button puts cars on up-peak operation, and *D* button initiates down-peak service. Below are four buttons to select cars for low-zone service.

The in-service buttons put cars in or take them out of service. Below these buttons is a row of call-backs with which the starter can call any car back to the bottom landing. Then comes a row of bypass buttons with which the starter can bypass calls, which would be answered by a car, and let a following one serve them. The keyed motor-generator switches for each elevator and the lights to show if these machines are in service are at bottom of panel.

Supervisory-System Operation. Now, how does the system supervise a bank of elevators in up-peak service? This is done in either of two ways, depending on the rate at which people enter the building. If there are enough cars to handle the traffic demand adequately, which there generally are, the starter presses up-peak button *U*. Then each car travels to the floor of the highest call. There, when the operator puts the car switch in start position, the car immediately reverses and returns to the ground floor.


Green lights indicate registered up corridor-calls
Red lights indicate registered down corridor-calls
Lights show position of each car in the hoistway
Green up-direction arrows
Red down-direction arrows
Start-down signal lights
Next down-car lights
Lights indicate when car bypasses a floor
Next up-car lights
Start-up signal lights
To increase or decrease final interval between cars leaving top and bottom landings
Buttons when pressed assign cars to low-zone service
Buttons when pressed put cars in service
Buttons permit starter to call any car back to ground floor
Pressing one of these buttons lets corresponding car bypass corridor-calls
Motor-generator key switches
Motor-generator running lights
Up
Down
Supervisory control
SM
Quota
Up-peak operation
Down-peak operation
Low zone
In service
Call back
Pass

2 At the starter's station on the ground floor there is a panel through which the several supervisory operations of the passenger-elevator bank are initiated

All cars are dispatched up automatically from the ground floor at regular intervals, except, if full, they are signaled away by the starter. The next car will be dispatched a full time interval from the time the previous car left the terminal. Cars are dispatched down from the floor of the highest call on an instant start-down signal. All floors are served by all six cars and all corridor calls are common to all cars.

Zone Up-Peak Operation. When up-traffic flow is extra heavy and cannot be adequately handled by all cars going to the highest call, which seldom happens, elevator capacity can be increased by changing to zone operation. To do this the elevators are divided into two groups and the building into two zones. One group of cars, say 1, 2 and 3, serves the high zone, while the other group, 4, 5 and 6, serves the low zone.

The starter initiates this operation by pressing the low-zone buttons for the cars he wishes to serve this zone. Passengers are directed to the cars serving their floors by lighted signs at the first-floor terminal. The cars in each group are dispatched up automatically from the ground floor on regular time signals, independent of those in the other group.

Off-Peak Operation. During most of the day when up-and-down traffic is about equal, all cars operate on a through-trip basis under automatically timed dispatching from top and bottom terminals, Fig. 3. Thus, cars are signaled in sequence at regular intervals from the terminal landings so all floors get uniform service. The starter puts elevators in off-peak operation by pulling out on his panel the up-peak and low-zone buttons if any are pressed in.

When the number of calls in each direction is uniform, the cars remain fairly evenly spaced. But there are short, heavy demands as when meetings gather or close, or at lunch time. During these traffic peaks, car round-trip time increases and the scheduled dispatching interval is too short. Cars cannot leave on schedule and there are long waits at some floors. When traffic becomes light, round-trip time of each car decreases and the dispatching interval is too long. Cars then arrive ahead of schedule and bunch at terminals.

Cars Behind Schedule. To decrease the round-trip time of a car behind schedule, the supervisory-control automatically reverses the car as soon as it answers the highest call. This occurs if there is no car at the top floor when the start-down signal is given.

To decrease the dispatching interval and avoid bunching the cars at the terminals, the anti-bunching feature comes into operation. If a car is waiting at the terminal when another car arrives, the interval of the first car is decreased one-half. If a third car arrives, the regular interval of the first car is decreased to one-quarter. If a fourth car arrives, the first car's regular interval is reduced to zero and it is dispatched immediately from the terminal landing.

Heavy Down-Traffic. When down-traffic is heavier than up-, cars tend to arrive at the top terminal ahead of schedule and so are forced into down-traffic earlier than normal. This increases the time available for each car to make the down trip and to handle traffic increase without exceeding the normal round-trip time. If the heavier traffic is in the up direction, the system handles the increased up-load in a similar way.

Down-Peak Operation. Down-peak conditions usually occur in office buildings for a relatively brief period around 5 pm when practically all the building's population must be brought to the ground floor in a short time. At the start of the period the dispatcher pushes button *D*. Then the supervisory system automatically divides the cars into two groups similar to up-peak operation. One group of cars serves the high zone or upper floors, while the other group serves the lower floors. Each group has its own timing dispatcher, which operates independently.

High-Zone Cars. Cars assigned to the high zone handle all traffic in the high zone and all up calls in both zones. The reason for the latter is that up passengers are taken direct to their floors. If a low-zone car stopped for an up passenger who was going to the 17th floor, he would have to transfer at the 14th. By having the high-zone cars handle all up traffic, passengers are sure of direct service. Usually at this time high-zone cars have only a few up calls. So this traffic has little effect on the high-zone cars' operation.

When this phase of supervisory control is in operation the high-zone cars bypass all down calls in the low zone. But if a down call in the low zone has been bypassed by a low-zone car because it is filled to capacity, the first unfilled high-zone down car automatically stops for down calls registered in the low zone during that down trip only.

Low-Zone Cars. Low-zone cars answer all low-zone down calls but no up calls. A car in the low-zone group travels to the highest down call registered in the low zone provided enough calls have been registered to fill an assigned quota. This quota represents the average expected number of stops a car is required to make. It is based

on a traffic survey of the building population.

When the number of calls registered in the low zone is not enough to fill the quota of a low-zone car, it goes to the highest call in the high zone, and stops to pick up passengers. Then it reverses and answers its quota of down calls to help out the high-zone cars.

At the moment a quota number of calls is registered in the low zone, the low-zone car that has traveled into the high zone makes a useful stop at the next down call. It immediately returns to the low zone where the traffic demand is concentrated, bypassing all other down calls that may have registered in the high zone.

Thus, the quota is only a measuring stick to determine if a low-zone car will enter the high zone to help out there. But if there are no calls registered above the load center, the low-zone car reverses automatically at the load center and returns to the ground floor, answering any call registered.

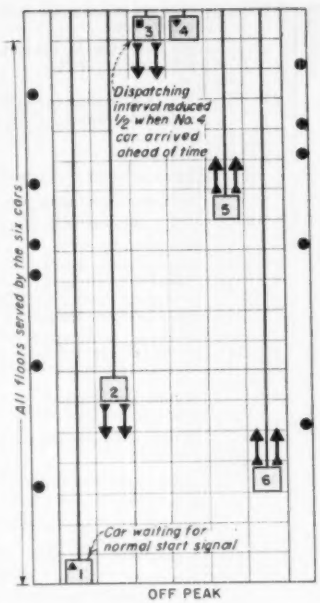
Quota Number of Calls. Quota of the low-zone cars is filled when an assigned number of calls has been registered in the low zone. This quota may be set to meet the traffic condition in the building at any given time or season, and may be 2, 3, 4 or more stops. Regardless of the number selected for the quota when the elevators were installed, the dispatcher can increase it one by pressing a button. Since all down calls in the low zone are common to cars in the zone, the number of down calls required for a car to receive its quota depends on the number of low-zone cars going down at a given time.

Let's say three low-zone down calls are the quota for cars in that zone and a car starts down. If no other cars are traveling up, any three calls below the load center will fill the down car's quota. When two cars are going down in the low zone at a given instant, six down calls must be registered to fill the second car's quota.

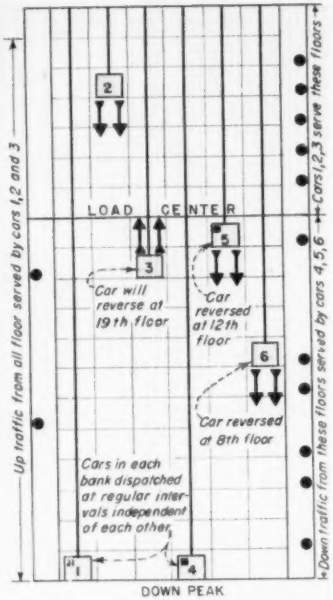
Consider the typical down-peak traffic conditions in Fig. 4. There is a fairly even distribution of down-traffic demand between the high and low zones. Cars 1, 2 and 3 are assigned to the high zone and handle the up traffic during down-peak operation, as well as down traffic in the high zone. Cars are dispatched in both zones at regular intervals independently of each other.

Car No. 3 in the high zone rises only to the 19th floor where the highest call is. There it reverses and starts down to pick up calls in the high zone. Car 5 in the low zone rises only to the 12th floor where the highest call is, since in this case its quota is filled, six calls for it and car 6. At the 12th floor, car 5 reverses and starts down to answer the calls. The system adjusts quickly to handle any other traffic condition.

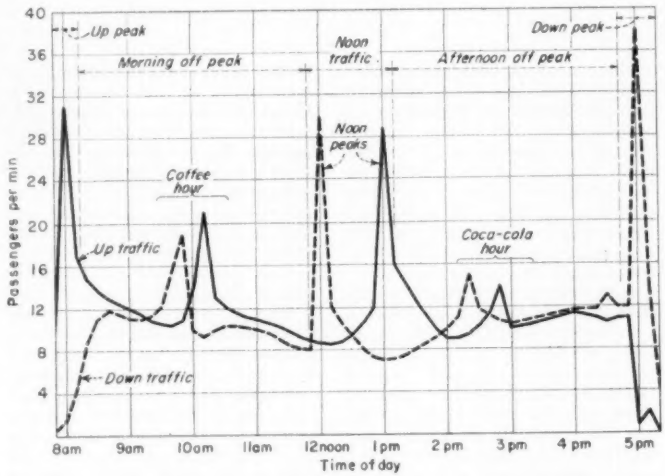
This is a general picture of how this automatic supervisory system operates to give uniform elevator service to all floors in a building. It permits the dispatcher to change easily and quickly to operating procedure to meet almost any emergency. The system's flexibility stems from the selection of the load center of traffic demand in the building, the number of cars that may be assigned to each zone, and the passenger-call quota, selected for the cars.


All floors served by the six cars
Dispatching interval reduced ½ when No. 4 car arrived ahead of time
Car waiting for normal start signal
OFF PEAK

3 During most of the day when up and down traffic is about equal, cars run through-trips, dispatched automatically

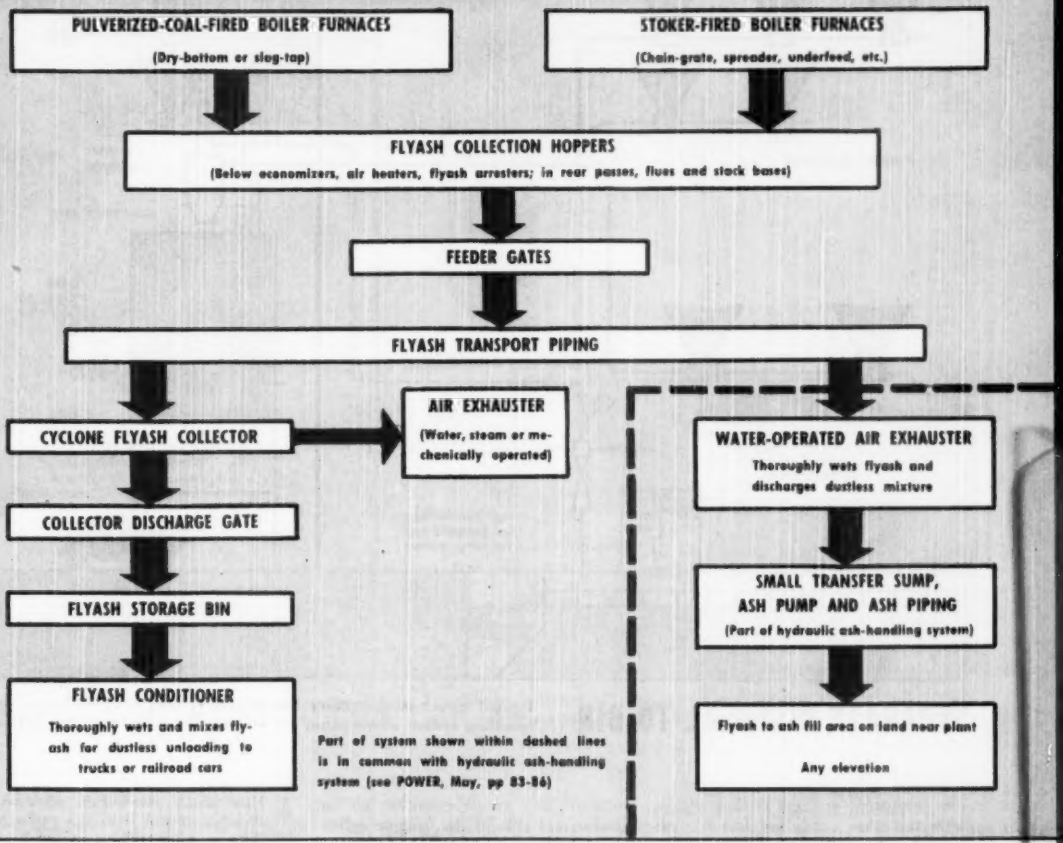

Up traffic from all floor served by cars 1,2 and 3
LOAD CENTER
Car will reverse at 19th floor
Car reversed at 12th floor
Car reversed at 8th floor
Cars in each bank dispatched at regular intervals independent of each other
Down traffic from these floors served by cars 4,5,6
Cars 1,2,3 serve these floors
DOWN PEAK

4 At beginning of the down-peak period, starter pushes button that automatically divides cars into two groups



5 These curves, plotted from a traffic study made in an office building, give a general idea of the peaks that occur in passenger travel on modern elevators

BASIC ARRANGEMENTS FOR PNEUMATIC FLYASH HANDLING


PULVERIZED-COAL-FIRED BOILER FURNACES
(Dry-bottom or slag-tap)
STOKER-FIRED BOILER FURNACES
(Chain-grate, spreader, underfeed, etc.)
FLYASH COLLECTION HOPPERS
(Below economizers, air heaters, flyash arresters; in rear passes, flues and stack bases)
FEEDER GATES
FLYASH TRANSPORT PIPING
CYCLONE FLYASH COLLECTOR
AIR EXHAUSTER
(Water, steam or mechanically operated)
COLLECTOR DISCHARGE GATE
FLYASH STORAGE BIN
FLYASH CONDITIONER
Thoroughly wets and mixes flyash for dustless unloading to trucks or railroad cars
Part of system shown within dashed lines is in common with hydraulic ash-handling system (see POWER, May, pp 83-86)
WATER-OPERATED AIR EXHAUSTER
Thoroughly wets flyash and discharges dustless mixture
SMALL TRANSFER SUMP, ASH PUMP AND ASH PIPING
(Part of hydraulic ash-handling system)
Flyash to ash fill area on land near plant
Any elevation

10 Answers to Your Questions on

PNEUMATIC FLYASH-HANDLING SYSTEMS

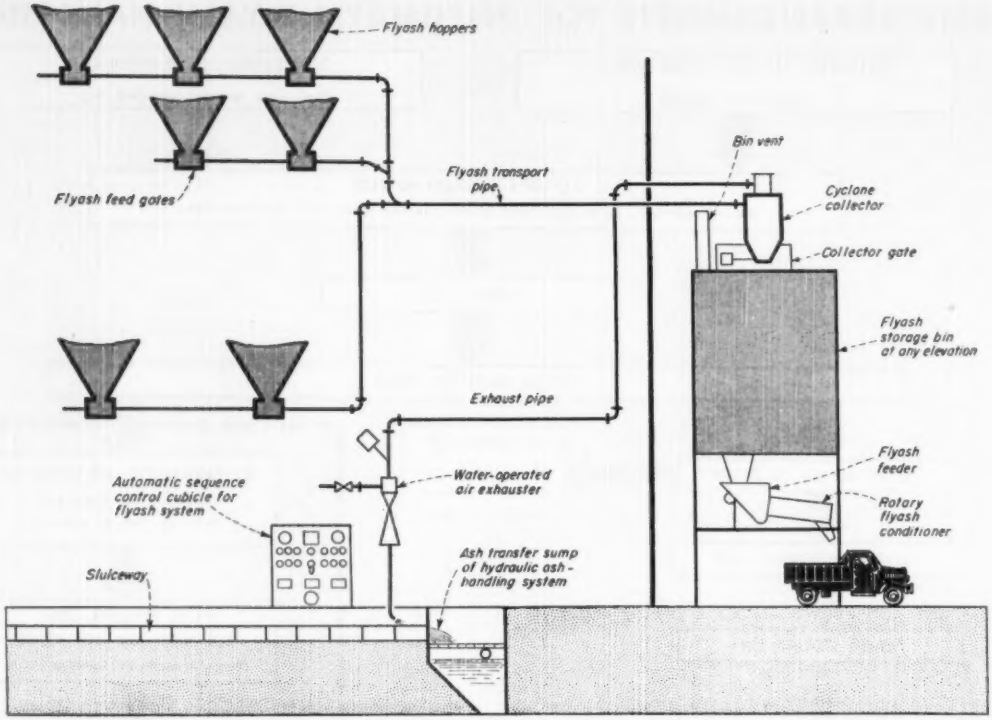
By H R PURSEL, *Manager, Hydraulic Ash-Handling Div, Beaumont Birch Co*

Flyash and dust collect at many points in modern steam generators. Pneumatic handling takes care of disposal conveniently and dustlessly, at high rates. Systems can be made entirely automatic

► IN LAST MONTH'S ARTICLE we covered hydraulic systems for removing ash from main ashpits and hoppers (May, pp 83-86). We noted then that flyash and dust continuously accumulate in secondary hoppers under economizers, air heaters and dust arresters, and in rear passes, ducts and stack bases. And that they are cleaned periodically, usually by a pneumatic system separate from the hydraulic system. Here are facts on the why and how of such hook-ups.

1 Why is flyash usually handled pneumatically?

Flyash, collected by modern dust arresters serving pulverized-coal-fired boilers, usually contains 75% or more dust finer than 325 mesh. It may amount to as much as 70% or more of the weight of incombustible in the coal. These fine sizes and large quantities preclude practical separation from water without installation of expen-



SEPARATE DISPOSAL TO BIN

Typical layout of pneumatic flyash system used with hydraulic ash-handling system where ashes are delivered to dewatering bin or sump

sive equipment or large settling ponds.

On the other hand, fine dust may be separated from air with relatively less equipment and expense. For this reason it is general practice to convey flyash pneumatically in a system separate from the hydraulic system serving the primary furnace hoppers. During conveying, the two types of ashes are not mixed except when they are pumped or sluiced directly to final disposal fill area on property adjoining the boiler house. In these cases, the dust-laden water seeps down through the voids of the larger ashes, where it automatically filters and drains off.

2 What are the elements of a pneumatic flyash system?

Material is conveyed in a confined air stream (under partial vacuum) from flyash collection hoppers to a point of collection or disposal. The system is completely enclosed, thereby eliminating escape of objectionable dust to the boiler room.

The system generally consists of a feeder valve at bottom of each dust hopper, a common transport pipeline connecting dust feeders with a cyclone collector, and an air exhauster on the downstream side of the cyclone collector. Flow diagrams above show typical arrangements.

3 How does such a pneumatic system usually operate?

Exhauster creates a strong air flow, at negative pressure, in the transport line. One feeder gate at a time delivers flyash from the hopper above it to the air stream in the pipeline. Flyash-laden air then continues through the pipeline to the cyclone collector. Here the flyash is separated from the air stream. As soon as one hopper is emptied, its feeder gate is stopped and the next feeder started. This sequence of hopper emptying continues until flyash has been removed from all hoppers of all operating units.

Cyclone collector automatically discharges dust through a gate to an atmospheric-pressure storage bin below. From this bin, dust feeds automatically to an ash conditioner. Here the ash mixes thoroughly with water. The resulting dustless mixture discharges to trucks or railroad cars. Diagram above shows a typical layout.

4 How about combining pneumatic flyash removal with the main hydraulic ash-handling system?

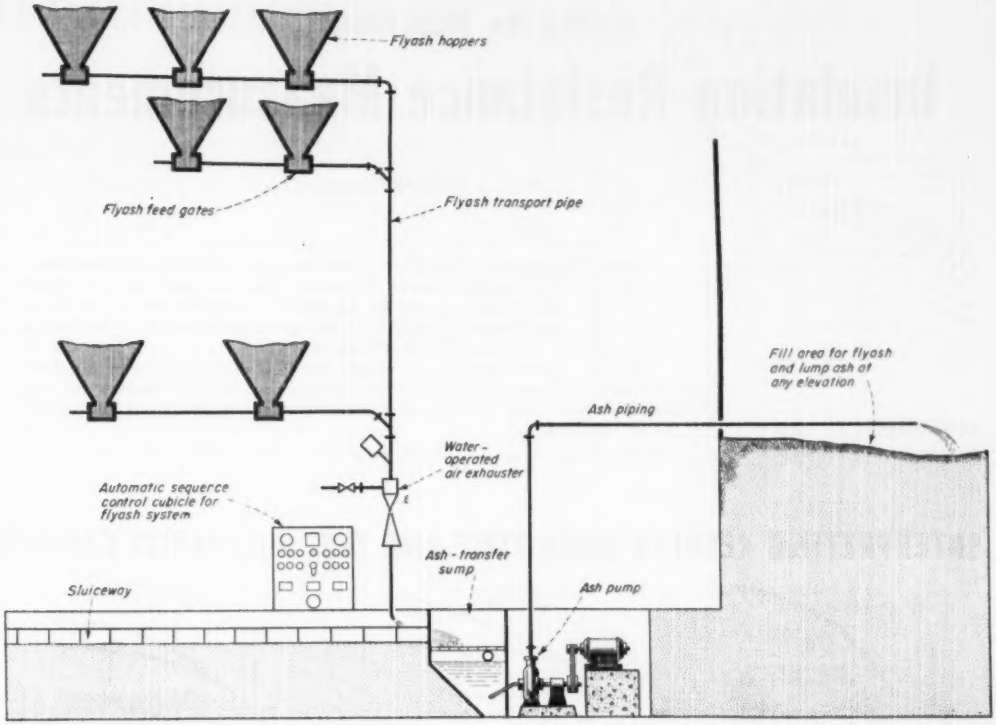
Such a combination can be applied when there is a fill area near the boiler house to which ashes and dust may be pumped from the ash-transfer sump. This scheme eliminates the cyclone collector, the dust-storage bin and the rotary dust conditioner. A water-fed exhauster automatically mixes the dust with water, at the same rate it is conveyed to the exhauster. The thoroughly wetted mixture discharges to the sluiceway or transfer sump for pumping to fill.

5 What flyash conveying rates can be obtained?

Pneumatic flyash-handling systems may be designed for a wide range of conveying rates. For plants producing large amounts of flyash, general practice is to design for at least 20 tph.

6 Any special design precautions required?

Conveyor pipe and fittings, exhauster venturis and inlet of cyclone collector



DISPOSAL WITH ASH TO FILL

Typical arrangement of pneumatic flyash system, used with hydraulic ash-handling system of type pumping ashes to fill area near plant

should be hard, abrasion-resistant alloy iron. For minimum friction loss, fittings should be the long-radius type.

7 What are the drawbacks of manual feeder-gate operation?

Secondary hoppers in which flyash collects are widely distributed at various elevations from bottom to top of boiler. Manual control of the feed gates and valves thus requires the attendant to walk long distances and climb or descend many stairs. While he moves from one location to another, and from one boiler to another, handling time is lost. From the time the operation begins, until its end, he must give full attention to it. In many larger plants, these drawbacks are serious. Hence the development of automatic sequence control to save labor and to boost capacity of flyash-handling systems.

8 How does the semi-automatic control method work?

In the manual method, the operator starts and stops each feeder gate at a station alongside that gate. In the semi-automatic method, there is a central electric-control station, usually in the ash basement remote from the feeders. A signal light shows when each hopper has been emptied of flyash. Then the operator pushes one button to stop that feeder, and another button to start the next. Just as in the manual system, times for starting and stopping are at his control. And operation requires attendance during the entire flyash-removal period. Total time needed is cut, however, since the operator does not have to walk from station to station, with flyash handling time lost between stations.

9 Can flyash removal be made fully automatic?

With automatic sequence control, the attendant only needs to start the operation. Automatic operation then continues in sequence, from one hopper to the next, until all units of one boiler have been emptied. Then the operation automatically moves to the first hopper of the next boiler and continues in like manner until all hoppers on all boilers have been emptied. Then the operation automatically stops. At the next flyash-handling period the cycle is repeated.

10 What are the elements of automatic sequence control?

Fully automatic sequence control provides a central control panel with signal lights, a selector switch to cut out sequencing on any boiler or boilers not being operated, a vacuum gage, and an electric sequence switch, which transfers operation from one feeder to the next immediately upon emptying of the hopper.

After starting the operation the system requires no attendance. Operator can do other work while flyash is being conveyed. No time is lost between emptying one hopper and start of flyash feeding from the next.

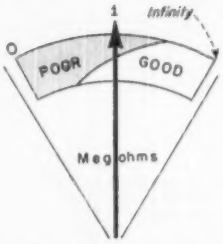
Before starting sequencing, the operator sets the selector switch on the control panel to handle flyash from operating boilers only. Any boiler not being fired can, therefore, be bypassed.

Automatic sequence control can be furnished for any number of flyash-collection hoppers per boiler and for any number of boilers in a plant.

Regardless of which of the three possible systems of feeder-gate control is used, operation of cyclone-collector discharge gate is automatically controlled.

Getting the Most From

Insulation-Resistance Measurements



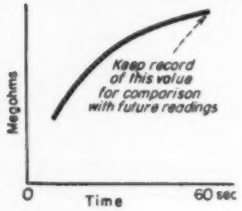
ONE MEGOHM per 1000 v is still a good practical guide

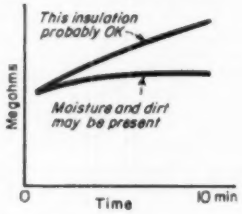
By J J O'CONNOR, *Assistant Editor*

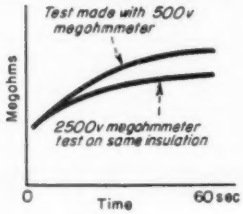
Electrical insulation is the blanket that wraps up each electrical conductor. Its job is to keep current leakage to a mighty low value and prevent voltage breaking through to opposite polarity or ground. About the best way to know whether your insulation is healthy is by measuring its resistance. The instrument generally used is called a *megohmmeter.*

But the megohmmeter is no "magic box." Values it indicates will vary depending on length of time for test, instrument voltage, temperature and humidity, etc. Your job is to analyze the readings in the proper light. And here's how to do it.

INTERPRETING RESULTS WHEN TIME AND TEST VOLTAGE IS CHANGED







Short-Time Test

There are three practical methods for measuring resistance of electrical insulation with a megohmmeter: (1) *short-time* or spot reading (2) time-resistance or *dielectric absorption* (3) *two-voltage*. Let's delve into the simple spot-reading procedure.

This method consists in simply connecting the megohmmeter across the insulation to be tested, and operating the instrument for a short time. The megohmmeter scale is read at the end of the period. And that value is taken as the insulation resistance. For a fast, routine check this method is OK.

But in the past some confusion has existed about when to stop the test since the value of insulation resistance would ordinarily keep climbing with time. This is somewhat important to those solely interested in the present exact value of insulation resistance. But in actual practice the precise value is far less important than the trend.

For purposes of standardization, however, 500-v dc applied for 60 sec is recommended where short-time single readings are to be made. In this way, comparison can be made on an equal footing to past and future test data.

Dielectric Absorption

Magnitude of a winding's insulation resistance generally increases as application time of dc-test voltage is lengthened. Actually, insulation resistance of a *dry* winding in good condition may continue to increase for hours.

But for practical purposes a fairly steady value is reached in 10 to 15 min. If winding is wet or dirty, a steady value is arrived at shortly after test voltage is applied. This variation is caused by the *dielectric absorption* of the insulation. Advantage is taken of this phenomenon because it goes a step beyond giving the mere value of insulation resistance. It indicates if insulation is wet or dirty.

With hand-cranked megohmmeters it's more practical to run the test 60 sec, taking readings at 30- and 60-sec points. But with motor-operated instruments (or others supplying constant-test voltage without need for hand turning) you'll get best results by running the test 10 min, taking readings at the 1- and 10-min points. Then, as a rule of thumb, when the 60:30 sec ratio is below 1.25, or where 10:1 min ratio drops below 2, the insulation's condition is questionable.

Using Two Voltages

Most routine insulation-resistance tests are made with a dc test voltage between 500 and 5000 v. Assuming we are testing the same insulation, note that insulation resistance usually drops as test voltage is materially increased. But for a variation of 2 or 3 to 1, in the usual test-voltage range, there is no appreciable change in resistance *for insulation in good condition.*

However, if insulation resistance is first tested on the short-time basis at 500-v test potential, and a second test is run on the same insulation at, say, 2500-v test voltage, then if you get as much as 25% drop in insulation resistance with the 4 to 1 test-voltage ratio, there is probably excess moisture in the insulation.

Now here's what any of these tests boils down to. It's not so much the keeping up to the minimum or standard values mentioned on the facing page that counts. The long-term value in insulation-resistance tests comes in keeping record of periodic tests. Then any persistent downward trends will be a fair warning of trouble even though the values may be higher than the suggested minimum safe values.

STANDARD RESISTANCE VALUES

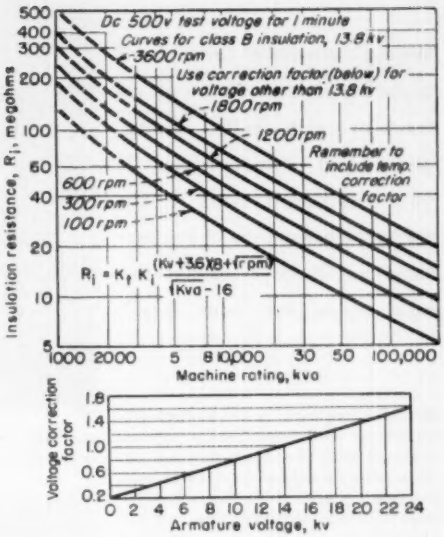
Ac Windings

We have already stressed the importance of maintaining records of insulation resistance. That's all well and good, but when this history is not available it becomes necessary to have some insulation-resistance level to serve as a guide when testing periodically.

It is impossible to specify exact insulation resistance at which a machine fails. So it is impractical to specify, exactly, minimum values of insulation resistance. Viewed in this light, it is logical that the standard value is not the minimum value for operation since it is quite possible to operate machines with insulation resistances about 1/10th the standard value. Well, what is this standard value? *For rotating-machine winding, standard value of insulation resistance is the least value a winding should have after cleaning or if a high-voltage test is to be applied to the windings.*

Curves, to right, are based on formula illustrated. Standard insulation resistance is R_1 at 40 C. In this same formula, k_t is insulation-resistance temperature coefficient as described below. And k_1 is insulation coefficient: 2.5 for Class A; 7.0 for Class B insulation.

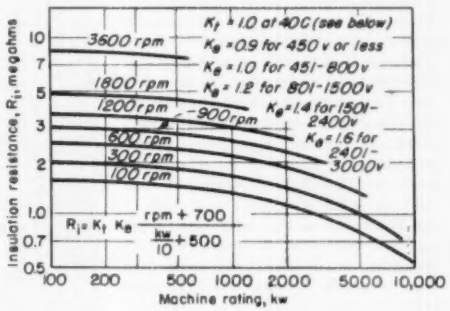
Where we are dealing with machines rated less than 1000 kva the accepted approach is the time-honored formula of one megohm per 1000 v with a minimum of one megohm.


Dc 500v test voltage for 1 minute
Curves for class B insulation, 13.8 kv
3600 rpm
Use correction factor (below) for voltage other than 13.8 kv
1800 rpm
1200 rpm
Remember to include temp. correction factor
600 rpm
300 rpm
100 rpm
$R_i = K_t K_i \frac{(Kv + 3.6)(8 + \sqrt{rpm})}{\sqrt{Kva} - 16}$
Insulation resistance, R_i, megohms
Machine rating, kva
Voltage correction factor
Armature voltage, kv

Dc Equipment

Note how the pattern changes for dc machines. Here we are generally dealing with low voltage; hence, insulation is less thick. In addition, dc equipment has a large exposed creepage surface.

The curves and formula cover dc armatures larger than 100 kw. But standard insulation resistance for armature windings less than 100 kw is about 1 megohm at winding temperatures up to 75 C. This test is made by applying a 500-v test voltage for 1 min and noting the reading at the end of that time. Remember: Before running an insulation test on dc machinery remove all brushes from their holders.

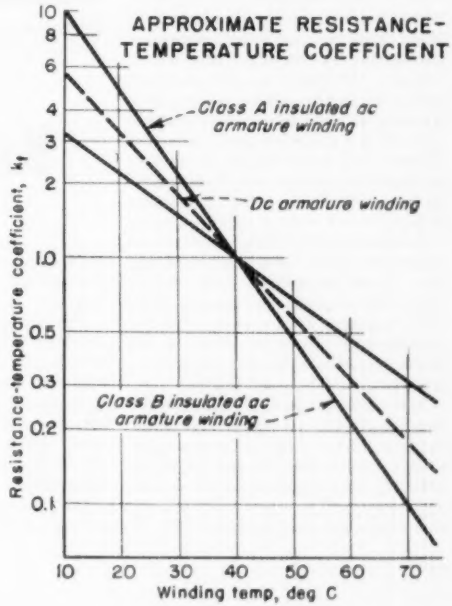

K_t = 1.0 at 40C (see below)
K_e = 0.9 for 450 v or less
K_e = 1.0 for 451-800 v
K_e = 1.2 for 801-1500 v
K_e = 1.4 for 1501-2400 v
K_e = 1.6 for 2401-3000 v
3600 rpm
1800 rpm
1200 rpm
900 rpm
600 rpm
300 rpm
100 rpm
$R_i = K_t K_e \frac{rpm + 700}{\frac{kw}{10} + 500}$
Insulation resistance, R_i, megohms
Machine rating, kw

Temperature Effect

Insulation resistance for most materials varies inversely with temperature. And since it is not always practical to measure insulation resistance at a specified temperature, approximate temperature correction factors are listed in curve form, to the right. So for reasonably accurate results, value of resistance indicated on your megohmmeter must be divided by the appropriate temperature correction factor to correct reading to the accepted base of 40 C.

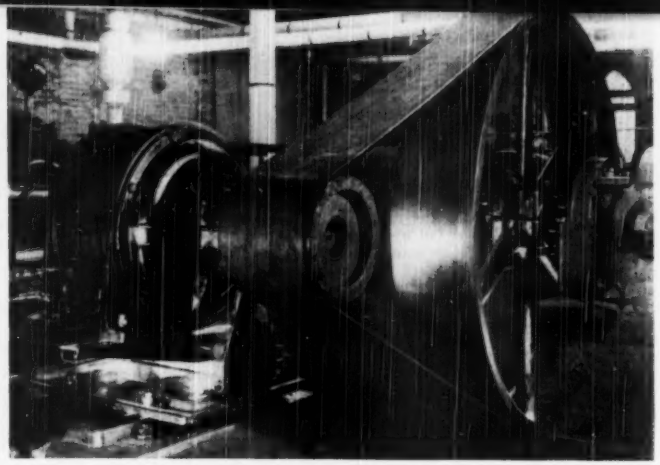
To illustrate importance of temperature correction, note the following: Resistance doubles for each 9-C drop in winding temperature for Class A ac armature windings. Likewise, it doubles for each 18-C reduction with Class B insulation. In a similar manner, insulation resistance of dc armature windings doubles for each 12-C temperature drop.

For more detailed information on this general subject of insulation resistance, refer to AIEE report No. 43, *Recommended Practice for Testing Insulation Resistance of Rotating Machinery.*

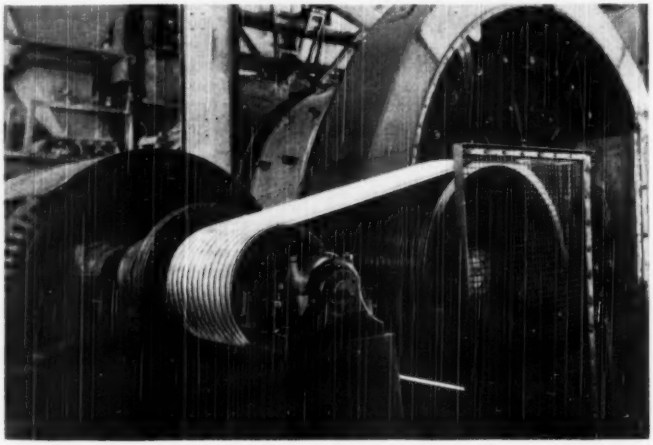

APPROXIMATE RESISTANCE-TEMPERATURE COEFFICIENT
Class A insulated ac armature winding
Dc armature winding
Class B insulated ac armature winding
Resistance-temperature coefficient, k_t
Winding temp, deg C

Know Your Loads When

Wrong estimate of driven load probably causes 75% of all troubles with belts, chains, gears and direct drives. If your selection is made on the correct answers to 13 questions you'll have picked the right drive for your load*



FLAT-BELT DRIVE. 100-hp 850-rpm squirrel-cage motor, on automatic tension base, drives air compressor through 15-in. flat belt on pulleys, 16.5- and 84-in. dia



MULTIPLE V-BELT. This hard-starting load, a ball-mill pulverizer, is driven by 125-hp synchronous motor through magnetic clutch, V-belt and herringbone gear

► WHEN APPLYING power-transmission equipment—flat belts, V-belts, chains, gears, flexible couplings or other devices—don't overlook the kind of load you are going to drive. Too often not understanding the load's power requirements causes trouble: (1) Connection between the motor and its load is expensive to maintain. (2) Production is below that expected. But knowing the load and selecting the drive accordingly will avoid these costly experiences.

Undersized Equipment. A desire to save on original cost is often cause for not providing power-transmission equipment of ample capacity. This practice is invariably paid for in high maintenance cost and production loss. It is folly to invest thousands of dollars in machines and motors, and then skimp on equipment cost to connect the two. Machine, motor and their connection form a production unit, and all parts must be ample for an efficient, economical job.

It is poor engineering to skimp on drive capacity. In fact, it is generally good business to install mechanical power transmission larger than the job requires. A drive that has ample capacity for the load under all conditions pays large dividends in long, trouble-free service and increased production. Then if the driven machine is called on to work heavier material than normal, ample power is available to take the load.

Machine Loads. Many machines require low starting torque and need constant power input when they are running. These units are comparatively easy to power. If you know what the running load will be, select motor and power transmission large enough for it and you should have no trouble.

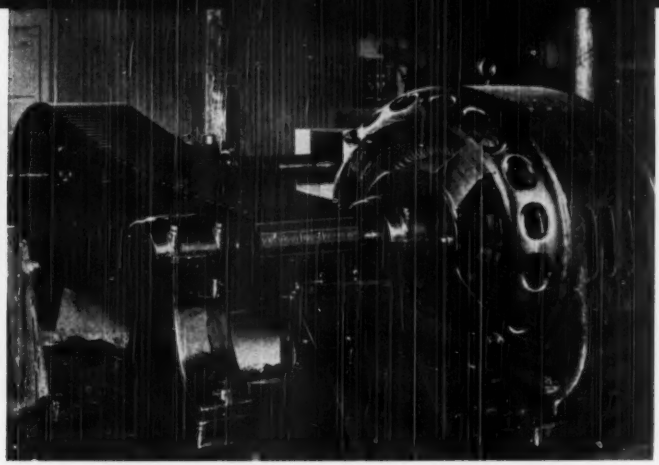
Many machine loads fluctuate badly, develop shocks, or require high starting torque. In some applications the three conditions may be present. When selecting drive equipment all must be taken into account and proper allowances made if you expect good performance.

Fluctuating Loads. A lot of machines develop at least fluctuating loads. Examples are reciprocating compressors and pumps, wood-working and saw-mill machinery, metal planers, lathes and grinders. For such applications the drive equipment must be selected to have ample capacity to transmit peak loads easily.

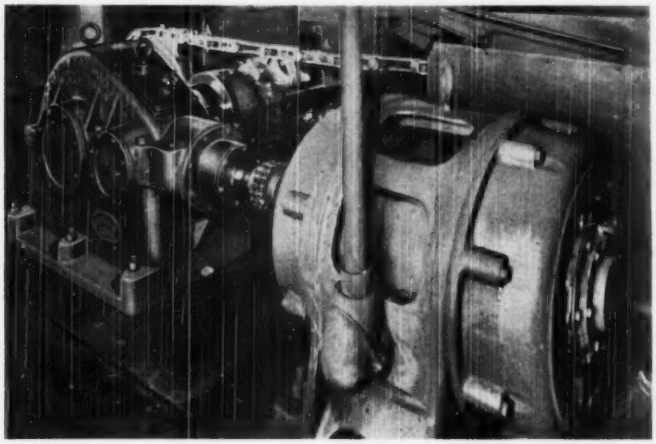
Drop hammers, punch presses, shears, pebble and ball mills, attrition mills, chippers, hogs, crushers, looms and similar machines have fluctuating shock loads. On such machines the drive must have sufficient capacity to take peak loads without distress as well as shock loads under which the peaks occur.

Left-hand curve, page 120 shows the fluctuating and shock loads developed by a drop hammer, which varies from 17 to 41 hp in about 10 sec. Between these low and high values the load fluctuates widely. On the right, the curve gives the characteristics of two drop hammers operated by a group drive. Here the

* This article is based on material supplied by the Power Transmission Council, New York, N. Y.



CHAIN DRIVE. 250-hp wound-rotor motor powers this fluctuating load, a paper-mill beater through 1½-in.-pitch 18-in.-wide chain drive operating at 1535 ft per min



GEAR SPEED REDUCER. Conveyors require slow speed so this one is driven by a 30-hp 850-rpm squirrel-cage motor through a triple-reduction spiral bevel gear

Buying Power Equipment

load varies from 20 to 90 hp. These load peaks must be provided for in the drive's design or you are headed for trouble.

Gradual Load Increase. Some machines may appear to have a constant load, yet close study shows that load increases gradually over a long period. It is important that you know how large the load will get, and select the drive with the necessary capacity. A spinning frame develops this type load. As the bobbins fill with yarn the load increases, although it may take several hours to reach its peak. Mixer and agitator loads also gradually increase. When the cycle starts, the fluid or mix may be thin and the load comparatively light. Later in the cycle the fluid thickens and may cause a high load peak. Be sure of maximum load condition when you select the drive, and be governed accordingly in your selection of drive equipment.

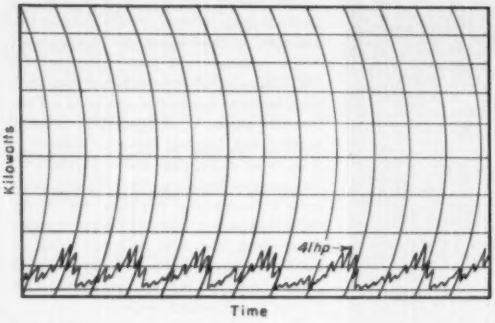
Unexpected Load Increases. These may occur because of changes in machine application or work—for example, when a drive is installed on a lathe or shaper brass, or other soft metals are being worked. Later, a shift may be made to iron or steel, or the cutting tool changed to one that takes deeper cuts. Either change will materially increase the load on the drive. When the drive fails because it was not designed for the heavier work, it is generally blamed without considering that the increase in load is at fault. But this attitude does not cure something that should have been foreseen and provided for in the drive's capacity. The only way to avoid these annoying and expensive occurrences is to power the machine with ample capacity for all conditions that it may be expected to serve.

Flour-mill roll stands may choke and greatly increase the power required to drive them. The same problem may occur in paper-mill beaters if solids get into the pulp. Other machines are particularly subjected to unexpectedly heavy load increases. To avoid trouble with drives on such machines select units of sufficient capacity to meet the unexpected loads within reason or provide protection that stops the machine when abnormal conditions occur. It may be advisable to let the drive act as a safety device when possible. For example, torque-limiting devices such as clutches can often be used to advantage.

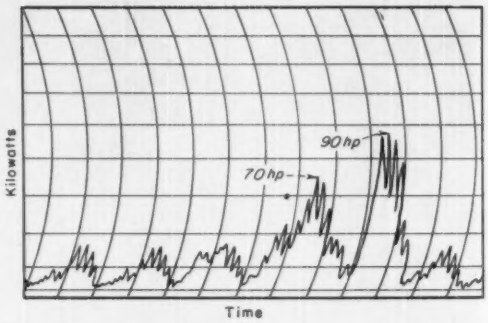
Hard-Starting Loads. Machines with heavy moving parts have high inertia to overcome; they are hard to start and bring up to speed. Included are units with heavy flywheels, such as compressors, punch presses and shears. Others are centrifugals, wood chippers, ball mills and crushers. Also, if a machine starts under working load, it is usually hard to move. Into this class fall ball and pebble mills, some types of conveyors, hoists and elevators, as well as reciprocating compressors and pumps starting under pressure.

Regardless of the power source, all machines that develop heavy starting loads must have their drive selected on the basis of the loads. Lack of enough capacity in the drive causes starting trouble and short drive life. Starting frequency is also important. All drives take care of an occasional abnormal start, but frequent, heavy starting must be provided for in the drive with ample capacity, if you are to avoid trouble.

Braking, Reversing Service. In addition to the machine's starting and operating characteristics you must consider if a brake is used in stopping or if rotation is reversed often. A brake may be applied to a unit in such a way that its action is transmitted to the drive. Likewise a machine that is running may be quickly stopped, reversed and accelerated to full speed in the opposite direction. Examples of the latter are certain designs of screw machines, tapping and threading machines, cen-



DROP-HAMMER LOAD. Fluctuating shock-type load follows fairly definite cycle that must be considered when selecting drive



HOW SHOCK LOADS BUILD UP. Load characteristics of two drop hammers. When in step, they cause severe power peaks

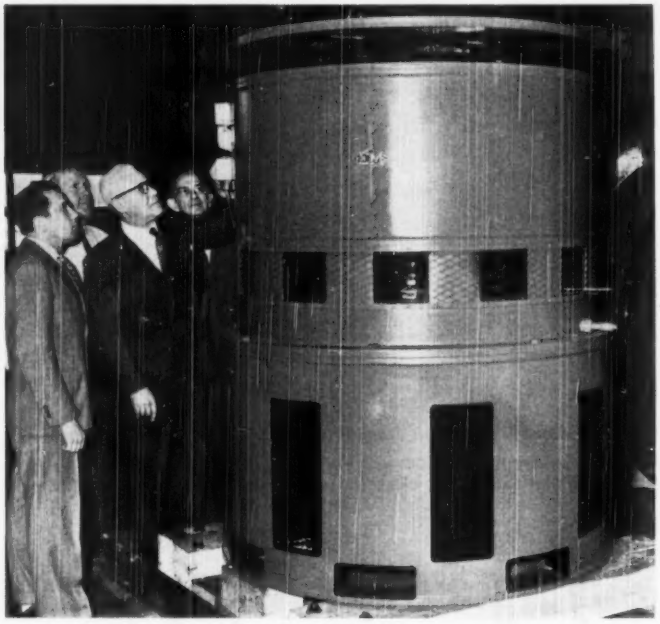
trifugals, wash wheels and others. If these conditions exist in a machine, their effects must be considered when selecting the drive size.

Correct Answers. No matter what the types of drive or from what source power is supplied, always obtain correct answers to the following questions before attempting to select the connection between driving and driven unit.

THIRTEEN QUESTIONS.

1. Does the machine develop a rapidly fluctuating load?
2. Is the load fluctuation regular or irregular?
3. Does the machine develop a gradually increasing load?
4. Of what time duration are the peak loads?
5. Does the machine develop a shock load?
6. Are the shocks frequent or occasional?
7. May the machine, at a later date, be required to do heavier work?
8. Is the machine subject to unexpected load increases?
9. Does the unit contain heavy moving parts, having considerable inertia to overcome in starting?
10. Does the machine perform work while being started?
11. Is the machine started often?
12. Is the drive subject to braking or reversing service?
13. Should the drive protect the machine from overload?

If, in addition to obtaining the normally required load data, you answer the above questions correctly, the machine will have high production and long drive life through the resulting drive design. Of course, you must also study the power source carefully.



MAGNETIC DRIVE ADJUSTS PUMP'S SPEED

► One of four magnetic-drive units, ordered by the city of Phildelphia for its storm-water pumping system, is being inspected in the shops of the Electric Machinery Mfg Co. These are the first vertical synchronous-motor adjustable-speed magnetic-drive units ever built for direct coupling to pumps.

Rated 400 hp at 514-rpm output speed, each drive consists of a synchronous motor mounted above the magnetic drive and directly coupled to it. The magnetic drive couples direct to the pump shaft and its housing bolts to the pump's casing. Precise control of pump speed is obtained by electrically adjusting the magnetic drive's excitation. By the electronic control, pump speed is adjusted to meet every change in water level. The complete order for the city of Philadelphia includes four vertical-synchronous-motor magnetic-drive units and eight vertical synchronous motors. The twelve units drive Worthington pumps.

Speaking of Power . . .

Our old friend George Edwards hoped to stir up some discussion when he wrote his April piece on . . .

instruction books . . .

and we knew he would. Matter of fact, he had a corking good letter from J B McMahon of Republic Flow Meters Co. As you might guess, manufacturers aren't always too happy about the use (or lack of it) made of their instructions. McMahon cites two problems the makers face and, recalling our days in the plant, his points are well taken. First, he wonders what happens to the instruction books sent out with each order. Here's what he says:

"We, and practically all other manufacturers, have desperately tried every conceivable means that can be thought of to ensure getting these instructions into the hands of the men who should have them. Practically every order calls for anywhere from 6 to 25 sets of instructions, which are sent out to some mailing address designated, and then apparently vanish into limbo. At least the operating men do not seem to get them. In addition to this, a great many of us include a set of instructions with each individual piece of equipment. . . . Even these disappear, however. Apparently it is a standard function of the person who opens the box to throw them into the nearest 'round file.'"

Something like this must happen often. We've been in plants that were shy on instruction books. And we've had letters from operators who took over instructionless plants and wanted to know where they could get such essential information. We suspect, also, that the dope gets buried in the front-office files—maybe even the Chief's.

McMahon also wonders why, when operators have the instruction books on hand . . .

they don't read them . . .

or apparently don't. He says, "We grant that a really competent operator will read the instructions that come with a piece of apparatus, but it is perfectly amazing how many engineers and operators there are who assume that, because they have been working with similar apparatus all their lives, they know everything there is to know about any new piece and so do not need to read the instructions."

And that's another bull's-eye. Lots of things that happen in plants wouldn't if the instruction books had been thoroughly studied—and followed.

Having scored these two well-aimed shots, friend McMahon returns to the basic point George Edwards makes —that too many instruction books are incomplete and hard to understand. McMahon agrees: ". . . I regard the writing of installing and operating instructions as a real art. It is not learned easily, and comes only as a result of wide experience in using the equipment under field conditions."

Finding a man to do this work is not unlike our job when we try to pick a . . .

new POWER editor . . .

something we do with prayerful deliberation. We're rather proud of our latest addition and would like to introduce him to you now. His name, Tyler Hicks, is familiar to our readers, for he's been a regular contributor. From that we knew he had the knack of putting technical material into readable and easily understood form. What we needed to know then was whether he had the kind of experience we wanted. Here's how that stacked up: After finishing high school in New York, he took to the high seas, held engineering jobs on steam and diesel ships, ended up as a "third."

TYLER G HICKS

He wanted an engineering education and got it —the hard way. Ashore, he took graveyard shifts running steam and diesel plants in New York hotels and industrial buildings while slugging his way through eight tough years at Cooper Union Engineering School. Then, with a mechanical degree, he decided to round out his experience with some design. Lockwood Greene Engineers, Inc, put him to work on design and planning of industrial power plants, heating and air-conditioning systems, refrigeration and piping.

That combination — practical operation and design — looked good to us. We think it'll look good to you when you see it at work in POWER's pages.

This kind of background would make a good writer of instruction books, too. And speaking again of instruction books . . .

we wonder . . .

if some manufacturer wouldn't like to try an experiment with us. Let's publish part of an instruction book in POWER. Then let's see what you, our readers, have to say about it. Are you game?

ELECTRONICS FOR THE POWER ENGINEER

By F A ANNETT, *Associate Editor*

26—Electronic Smoke-Density Indicators: Part 2

► PHOTOELECTRIC smoke-density-indicating equipment is designed to indicate or record continuously smoke or haze density from a boiler furnace. In some designs, like the ones described in May, relays sound the alarm and energize the signal lamps. In other designs, these functions are performed by thyratrons (gas-filled electron tubes), as in the two types we will study here.

Thyratrons as Relays. Fig. 1 is the wiring diagram of a Brooke Engineering smoke-density indicator and recorder in which thyratrons are connected in a push-pull circuit, such as we studied in November POWER, p 118. This diagram looks a little more complicated than the one using relay. But it is quite simple so we will learn a few more circuit tricks.

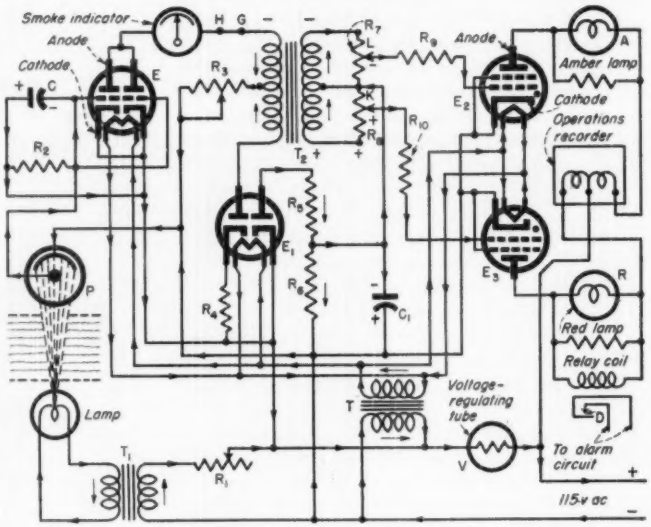
In this equipment the photoelectric tube only is in the eyebox on one side of the stack or breeching. On its other side is the light source, transformer T_1 and resistor R_1. The other parts of the indicator, with the exception of the operation recorder, are assembled as a unit, located near the boiler operator.

Power for operation comes from a 115-v ac supply. Except for the alarm, lamps and alarm relay, all power goes through a voltage-regulating tube V. This tube helps maintain nearly correct voltage on the different tubes.

Light-Source Transformer. Transformer T_1, through adjustable resistor R_1 and the voltage-regulating tube, supplies power to the light-source lamp. A change in the voltage on the lamp has the same effect as a change in stack-gas density and so it is necessary that the voltage be held nearly constant. Resistor R_1 adjusts the amount of light reaching the phototube and fixes the smoke density at which the red lamp will light.

Adjusting the light source also compensates for a small amount of dirt on the light-beam lenses. As dust collects on them, resistor R_1 can be cut out of the circuit. When it is all out, the lenses need to be cleaned and the resistor cut into circuit to the original adjustment.

Circuits Explained. To follow operation of the circuits assume correct stack-gas density. Under this condition phototube P conducts and its circuit is from − line through the tube, resistor R_3 and to the + line. Capacitor C is charged to a polarity shown.



1 The stack-gas desity indicator in which the relays have been replaced by two thyratrons E_1 and E_2 that control the signal-lamp circuit and sound an alarm

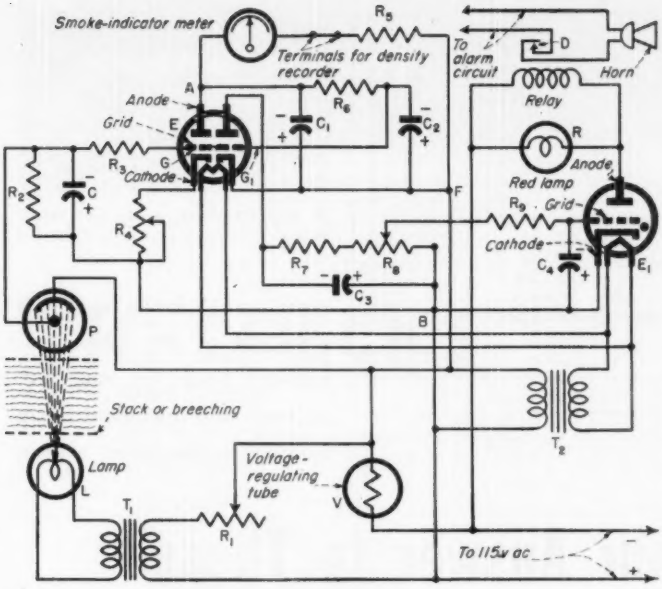
A minus bias is put on the grids of tube E_1 from the phototube, to the grids, to the cathodes, and to the + line. On reverse-line polarity capacitor C discharges through resistor R_3 and maintains minus bias on the grids, from the capacitor to the grids, the cathodes to the + side of C.

Minus bias on the grids of tube E is such that the tube passes a current corresponding to the haze in the stack for best operation. To trace the tube circuits assume that the power-source polarity has reversed. Then current flows through the voltage-regulating tube, through both cathodes and anodes of tube E, the smoke indicator, top half of transformer T_2, part of resistor R_3 and to the + line.

Current also flows through tube V, resistor R_4, left-hand cathode, anode of tube E_1, bottom half of transformer T_2, part of resistor R_3 and to the + line. The two currents flowing in the primary of transformer T_2 are equal and opposite for the stack-haze conditions being considered. So the tranformer's core is not magnetized and voltage in the secondary winding is zero, just as if it were not part of the transformer.

Current also flows through tube V, the right-hand cathode and anode of tube E_1, resistors R_5 and R_6, back to the + line. A tap from between R_5 and R_6 connects between resistors R_7 and R_8 and to the midpoint of transformer T_2 secondary.

Thyratron Grid Bias. This connection puts minus bias on the grid of thyra-



2 Simplified form of the stack-gas density indicator, shown in Fig. 1, in which control tube E_1, transformer T_2, and one of the thyratrons has been eliminated

trons E_2 and E_3. Direction of this potential is from between R_5 and R_6, to between R_7 and R_8, through top half of the secondary winding and of resistor R_7 to the grid of E_2, its cathode to the bottom end of R_5 and the + line. Thyratron E_3 grid circuit is down through the bottom half of the secondary winding and of R_8, resistor R_{10}, grid of E_3, its cathode to the bottom of R_5 and + line.

Voltage on the grids is that across R_6, to which capacitor C_1 connects. This capacitor is charged to the polarity shown, so when line polarity reverses and tube E_1 does not conduct, the capacitor maintains minus bias on the grids of E_2 and E_3 thyratrons. The capacitor also discharges through resistor R_6. Minus bias on the grids of E_2 and E_3 is high enough to prevent these tubes from conducting.

Dense Smoke in Stack. Assume the stack gas becomes so dense that all light to phototube P is interrupted. This tube then ceases to conduct and the minus bias on tube E grids drops to zero. This tube then conducts maximum current that flows through the upper half of transformer T_2 primary, resistor R_5, to the + line. Because of the effects of resistor R_5 in the circuit, when the current increases in the upper half of T_2 primary winding, it decreases in the bottom half.

Since current in top half of the winding is larger than in bottom half, the former will magnetize the transformer's core. This will induce a voltage in the secondary opposite to that applied to the top half of the primary as shown. Secondary voltage causes a current to flow through resistors R_7 and R_8 as indicated.

This current creates a potential of the polarity shown, between point L on resistor R_7 and K on R_6, which is applied to the grids of tubes E_2 and E_3 in series. Its direction is from L to the grid of tube E_2 and to the cathode of this tube and that of tube E_3. Then to the grid of this tube and to K on resistor R_6.

Bias on E_2 grid is made more minus to block this tube and is reduced on tube E_3 to where it conducts. This circuit is from the – line, cathode of tube E_3 and to its anode, the red lamp R, the operations recorder's left-hand coil to the + line. The alarm relay coil is also energized and it closes its contact D to sound a gong or horn. The operations recorder's pen moves to a position that shows the stack gas has been too dense.

Light Haze in Stack. If the stack gas becomes too clear, minus bias on the grid of tube E becomes so high that current flow through this tube is below that in the left-hand side of tube E_1. Under this condition, current flow in bottom half of transformer T_2 primary is greater than in top half. This gives the secondary opposite polarity to that shown, and makes point K minus on resistor R_6, and L plus on R_7. Grid of tube E_3 is now more minus and that of E_2 less. This tube conducts to light lamp A and actuate the recorder.

In the equipment, Fig. 1, the smoke indicator shows at all times the haze or smoke density in the stack and how far it is away from best combustion conditions. The operations recorder shows only when the gas density is above or below good operating conditions and the duration of these periods. If a record of stack-haze density is required, jumper between G and H can be removed and a continuous recorder connected to these two terminals. This instrument will record stack-gas conditions shown by the smoke indicator.

Simplified Indicator. Fig. 2 is a simplified form of the indicator in Fig. 1. In this indicator, control tube E_1, transformer T_2 and thyratron E_2 have been eliminated to reduce equipment cost. The amber lamp has also been omitted so an alarm is given only when the stack gas becomes objectionably dark.

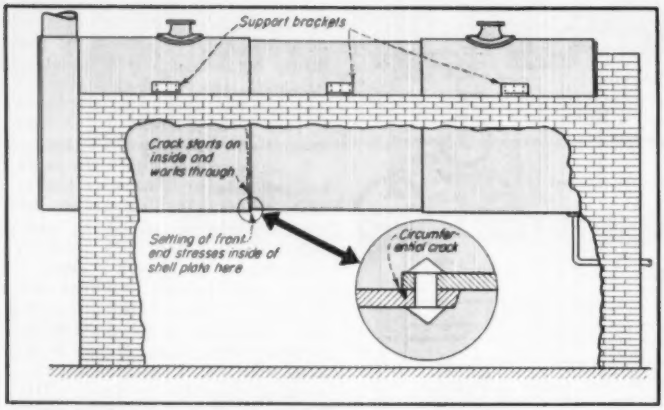
But the smoke-density indicator shows the stack-gas density at all times, which is a good guide to the boiler operator. One of the purposes of this equipment is to give a warning when smoke approaches an unlawful density. Then something can be done before the law is violated.

Light-Source Lamp Circuit. A circuit for the light-source lamp L is from the – line, through tube V, resistor R_1, transformer T_1, to the + line. Assume stack-gas density is normal so the light beam can cross the stack and the phototube conducts. This circuit is from – line, tubes V and P, resistor R_3, to the + line. A minus bias is put on grid G of tube E through resistor R_4, the grid, cathode, part of resistor R_4, to the + line.

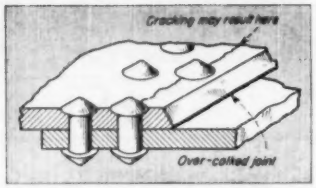
Minus bias on grid G of tube E permits the tube to conduct a comparatively small current. This current flows when circuit polarity reverses through part of resistor R_4, left-hand cathode and anode of tube E, smoke meter, resistor R_2, tube V back to the + line. Voltage drop across R_2 puts minus bias on grid G_1 of tube E. This voltage is applied from A, resistor R_4, grid G_1, the cathode to F and the + line.

Because of the comparatively low current flowing through R_4, minus bias on grid G_1 is quite low. Capacitors C_1 and C_2 are also charged to the polarity shown. On reverse-line polarity these capacitors maintain minus bias on grid G_1. Capacitor C_1 maintains a potential

(*Continued on page* 156)


Support brackets
Crack starts on inside and works through
Setting of front end stresses inside of shell plate here
Circumferential crack

1 **HRT BOILER,** when supported by brackets resting on the brickwork, may "break its back" if the brickwork settles unevenly at the front and rear of the unit



2 **RIVETED JOINT** may be overstressed by excessive use of calking compound

Here are 11 boiler questions right out of the license examiner's book. Try your luck on them and then read Harry Spring's on-the-beam replies

What's Your Answer to These?

1 What is meant by an hrt boiler "breaking its back"?

Severe end-to-end bending and tensile stress cause an hrt to "break its back," Fig. 1. This happens when front and rear foundations settle under a boiler supported by three brackets resting on the brick walls.

2 How do you know it is time to blow soot by observing the steam-flow, gas-temperature and draft chart?

As soot builds up, flue-gas temperature line goes up also. After a 50- to 100-F rise, soot should be blown. Abrupt drop in temperature should follow.

3 What harm can soot do in a boiler?

It may combine with any moisture present to corrode exposed parts of the boiler. Being a good insulator, it retards heat transfer and so wastes fuel. It also chokes gas passages, which may cause a furnace explosion.

4 If low water occurred in a watertube boiler, causing tube rupture, what would you look for on a typical 3-pen boiler meter?

Flue-gas temperature would gradually rise as water receded. Draft pressure would surge and steam flow would drop at instant of tube rupture.

5 (a) How far should a tube protrude when installed in a firetube boiler?

Enough to bead the ends properly after they are rolled tight.

(b) What would you do if a tube were a little too short?

Tube may be expanded a little over ⅛ in. by inserting a steam hose and allowing steam to blow through the tube a few minutes. Roll it in while hot. Don't use this method for a number of tubes because contraction stresses may buckle the head and set up leakage from adjoining tubes.

6 What are common causes of inaccuracy of steam gages?

Loss of siphon sealing water causing overheating; vibration; freezing; unthrottled pulsation of pressure.

7 What would you do if you noticed steam leaking from the brickwork near the boiler drum?

Shut boiler down at once. Let pressure drop gradually. When pressure is down remove masonry in vicinity of leak, find out the cause, and see if any wasting of the plate has occurred. If plate has wasted or if there is anything more than minor leakage past a threaded joint, have local boiler inspector investigate before operating boiler. If minor leakage has been occurring past a threaded joint, clean threads and make joint tight.

8 What precautions would you take in calking a riveted joint?

Never calk it under pressure except that of cold water. Use a blunt calking tool, holding it at proper angle so as not to score the under plate. Do not calk excessively or plate may be raised, setting up severe stresses, Fig. 2.

9 Do small amounts of water in fuel oil change appearance of the flame in the furnace? How?

Yes. Sparkling white streamers shoot out from the ends of the flame.

10 If a riveted joint can't be made tight by recalking, what would you do?

Chip back 1/16 to ⅛ in. along the calking edge, and calk new edge. A light bead of seal weld may be used except on longitudinal joints. To prevent heating and distortion of entire joint, use an electric arc.

11 What are common causes of a reciprocating feed pump racing or short stroking?

(a) Steam binding—temperature of suction too high for suction head. In an emergency bleed cold water into suction or turn cold-water hose onto pipe. For permanent cure limit temperature or increase suction head.

(b) Air binding—air leak in the suction line.

(c) Water valve stuck in open position causes racing.

(d) Loss of discharge head from broken line or other cause.

(e) Defect in pump governor if under governor control.

(f) Loss of suction supply.

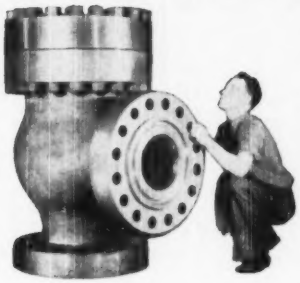
(g) Short stroking can result from improper adjustment of steam or cushion valve.

(h) Improperly adjusted tappet causes short stroking in a simplex pump.

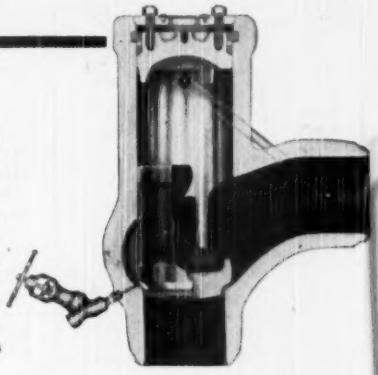
PIPING FLEXIBILITY *with* Edward *Check Valves*

FOR large, medium or small lines . . . for horizontal, vertical or angle installations . . . for 150 lb to 7500 lb service . . . stainless steel or Stellite trim . . . whether you need flanged, screwed or welding ends—there is an Edward steel check valve to meet your requirements. Many sizes and types are in stock for immediate shipment.

BIG CHECKS



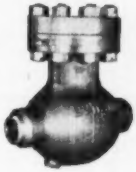
Vibration, clatter and damaging shock to piping are eliminated with Edward piston-type check valves. Integral guide ribs, cored out for free flow, guide the hourglass disk-piston throughout travel to prevent hanging up. New flow contours reduce pressure loss, increase operating efficiency. Built in sizes through 14 in.



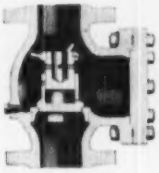
AVAILABLE IN HORIZONTAL ~ . . . ANGLE ⌐ . . . VERTICAL |

MEDIUM

Exclusive Edward disk guide lip aids tight seating and cuts wear on seat and disk through momentary throttling action.



Edward check valves may be disassembled without removing from the line. Covers are forged steel.



AVAILABLE IN HORIZONTAL ~ . . . ANGLE ⌐ . . . VERTICAL |

SMALL

Edward forged steel check valves are spring loaded to insure quick, accurate seating. Bodies are streamlined.

For viscous fluids or hydraulic service, Edward ball checks are ideal. Stainless steel ball is mated to seat.

Design of small Edward checks permits use in either horizontal or vertical lines. Built in sizes down to ¼ in.

AVAILABLE IN HORIZONTAL ~ . . . ANGLE ⌐ . . . VERTICAL |

Another Rockwell Product

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

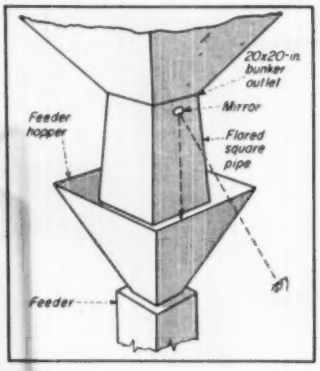
EAST CHICAGO, INDIANA

A REQUEST ON YOUR COMPANY LETTERHEAD WILL BRING EDWARD CATALOG No. 103

POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

PULVERIZER-FEEDER HOPPER SOLVES COAL-ARCHING PROBLEM



WHENEVER OUR RAIL SHIPMENTS of coal are interrupted we have to use coal from our outside pile that is wet and often frozen. We have had considerable trouble with this coal arching in the bunker outlets. These bunkers supply feeders for our pulverizers. Bunker outlets were fitted with 10-in. gates and pipes at their discharge outlets.

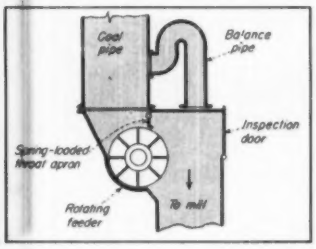
In surveying the general arrangement we found the bunker outlets were actually 20x20 in., compared with the 10-in. gates and pipes. We tore out the latter two items and substituted a 20x20-in. square pipe, flaring out toward its lower discharge end, as in the sketch. We fitted the feeder inlet with a large hopper, open at the top. It holds about a 10-min supply of coal. The picture shows a truck rear-view mirror at the top of the square pipe through which the firemen can see the coal in the hopper.

This alteration has greatly reduced the arching because of the greater span over which the coal must pack. In addition, the feeder hopper contains an ample coal supply so the operator has enough time to break up the arching when it does occur.

We find that lack of a coal gate at the bunker discharge is of no consequence. The sliding gate over the star wheel of the feeder gives all the control we need over coal flow.

A R EASTCOTT *Princeton, B. C.*

BALANCE PIPE IMPROVES COAL-MILL FEEDER CONTROL

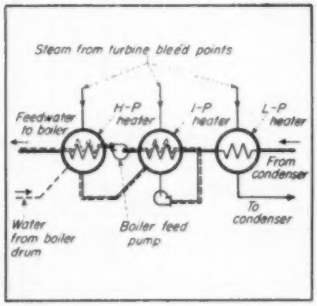


OUR COAL PULVERIZERS operate best under a negative pressure of about 2 in. of water. This, naturally, places a pressure differential across our coal feeders. Whenever we ran fine coal we had trouble because it sifted past the spring-loaded throat apron. This could be stopped only by taking the negative pressure off the mills with resulting poorer operation.

To maintain negative-pressure operation we decided to remove the pressure drop across the feeder by installing a balance pipe around it. We cut suitable openings in coal pipe and feeder case, and installed a gooseneck connection as in the sketch. Lowest point in the gooseneck is about two inches above the highest point in the coal-pipe opening. This prevents any coal bypassing the feeder, but freely passes air flow induced by the mill negative pressure. We have no trouble now.

J A SWANSON *Princeton, B. C.*

BOILER WATER BUFFERS FEEDWATER IN HIGH-PRESSURE HEATER



FOR SEVEN YEARS we have had iron-oxide deposits in our 400-psig boiler drum. The oxide came from the closed feedwater heaters, boiler feed pump and feed piping. The water was low in oxygen but a low pH caused the corrosion. To raise the pH we buffered the feedwater with boiler water.

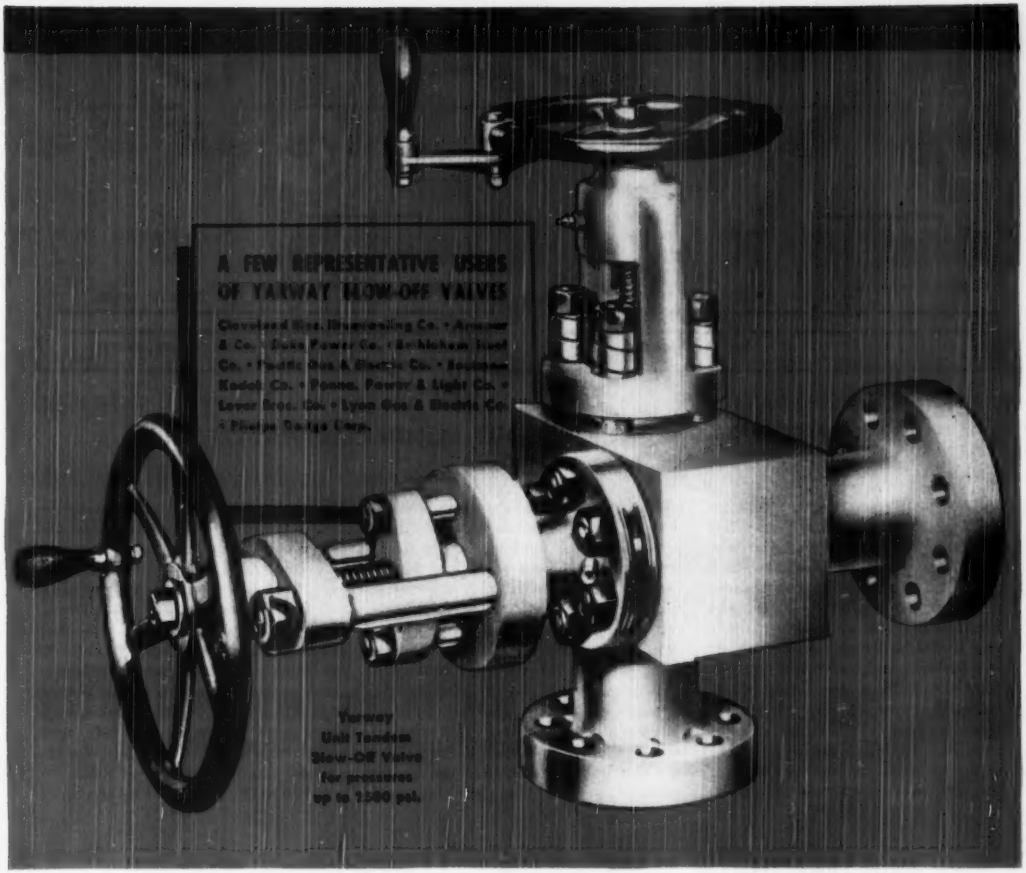
Boiler water was taken from the drum through a muffled orifice and discharged into the high-pressure heater shell. Dotted line in the sketch shows the path taken by the buffering water through the feed-heating system. By introducing the water as shown the intermediate-pressure heater, boiler feed pumps, high-pressure heater and piping are protected.

All boiler-water energy remains within the plant system with no need for extra fuel. The only energy cost is the small additional amount for pumping through the heater condensate lines.

We calibrated the muffled orifice for full load, and do not change it for light loads. We always keep the pH in the boiler drum at a safe level, so there is no need for changing flow.

L R ANDERSON *Albert Lea, Minn.*

(*Continued on page* 128)



TIGHT! STRONG! for even toughest blow-down requirements

The Yarway Unit Tandem Blow-Off Valve meets the most demanding requirements for boiler blow-down or drain service.

It's drop-tight—and rugged enough to withstand the severe punishment of regular or emergency blow-down under pressure, or periodic acid wash.

Two Yarway Stellite-Seat Hard-Seat Valves or a Hard-Seat (blowing) and Seatless (sealing) Valve are combined in a one-piece forged-steel body. Designed for pressures up to 2500 psi.

It is significant that more than 4 out of 5 high pressure boiler plants use Yarway Blow-Off Valves.

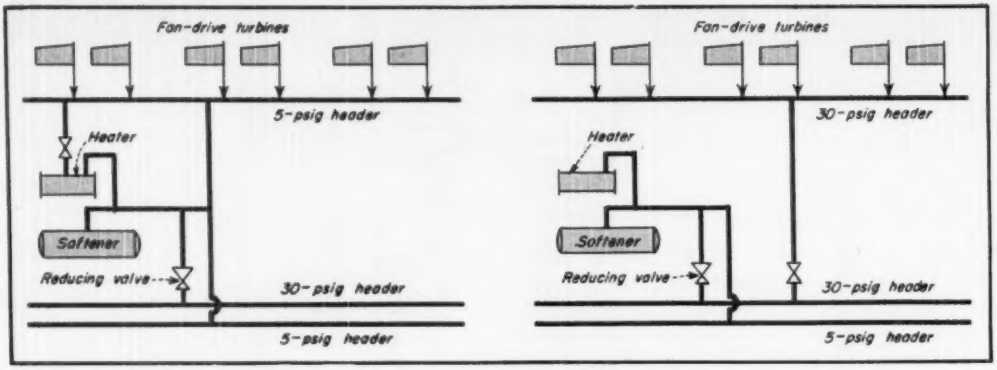
For more facts, see Yarway Bulletin B-432.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
Branch Offices in Principal Cities

YARWAY

BLOW-OFF VALVES

 (Continued from page 126)



CHANGING HEAT-BALANCE LAYOUT ELIMINATES WASTE STEAM

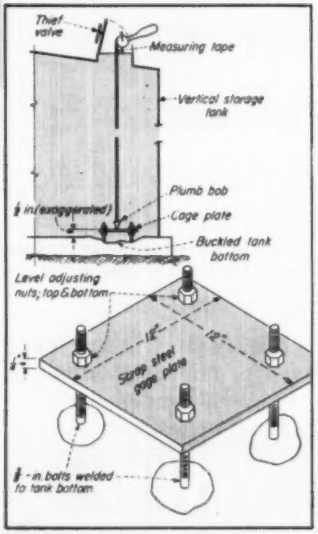
WE HAVE BOTH FORCED-DRAFT and induced-draft fans on our boilers. They have dual drives, electric motor and steam turbine on the same shaft. These turbines exhaust into a 5-psig header that supplies a feedwater heater and water softener. The original hookup is shown in the left-hand sketch, above. Stoker-turbines and boiler-feed turbines furnish the bulk of the 5-psig steam through the lower header. Whenever we had to repair a fan motor and run the turbine, or run a fan at low load with the turbines, we had an excess of steam that was discharged to atmosphere causing a considerable fuel loss.

Our 30-psig line supplies our low-pressure process and heating. The steam comes from reducing valves and the exhaust of our steam-driven compressors. Excess pressure on the 5-psig system occurred often enough to warrant taking steps to correct the steam wastage. After studying the setup we concluded the cheapest way lay in altering the turbines on the fan drives to exhaust at 30 psig instead of 5 psig. We checked with the manufacturers on the ability of these units to withstand the higher exhaust pressure. After receiving their OK, we renozzled the turbines by increasing their cross-sectional area and increasing the pitch. This was necessary to develop the same shaft speed with the lower available pressure drop, that is, by increasing the steam flow.

We also changed the piping hookup as shown in the right-hand sketch. At the same time we made appropriate changes in relief-valve settings. Now we have eliminated 5-psig discharge to atmosphere to maintain steady feedwater temperature at all loads. We can also use our fan turbines at will.

A ROCKLIN *Chicago, Ill.*

ADJUSTABLE-LEVEL PLATE SOLVES TANK MEASURING PROBLEM



IN OUR INDUSTRIAL PLANT we have several outdoor fuel-oil storage tanks. Contents are regularly measured by dropping a metal tape through the "thief" valve. A heavy plumb bob on the end of the tape keeps it vertical during measurements.

Over a period of years we noticed increasing disagreement between fuel-oil delivery bills and tank measurements. On draining and inspecting each tank, when opportunity offered, we discovered the bottoms had buckled as a result of poor installation. In addition, severe corrosion of the tank bottoms had occurred directly under the thief valves, where plumb bob struck the metal. To make more uniform measurements and reduce corrosion from pitting, we installed in each tank the gage plate shown in the sketch. Plates were made from scrap steel, 12x12x ¼ in. Four threaded supports, each with two nuts, were welded to the bottom. They support the plate at each corner.

Top of plate was leveled at about ½ in. above tank bottom. Tightening upper nuts kept the plate in place. Careful checks were made to see that plate locations were alike in all tanks. This made it easy to correct for discrepancy by having the base above true tank bottom.

Several years use of these plates has shown that tank measurements are more accurate and bottom corrosion has lessened considerably.

TYLER G HICKS *Summit, N. Y.*

The Editors Invite Contributions

Here's your chance to cash in on one of those professional tricks you have used in your plant. POWER pays $20 for each item published here on problems in design, operation and maintenance. Your contribution need be in rough form only—just set down all facts with sketches in pencil. We will do any editing that is needed.

SUNVIS 900 OILS

are good for the life of your turbines

Continuous, efficient turbine operation. That's what Sunvis 900 Oils provide. They do not form the sludges, gums, resins, varnishes, or corrosive products that clog lines and attack precision-fitted parts. They do not permit rust formation, and they prevent the corrosion that pits and eats away metal.

Quality-wise, they are unsurpassed. Experience shows that under normal operating conditions Sunvis 900 Oils are *good for the life of your turbines*. For complete information, call or write your nearest Sun Office.

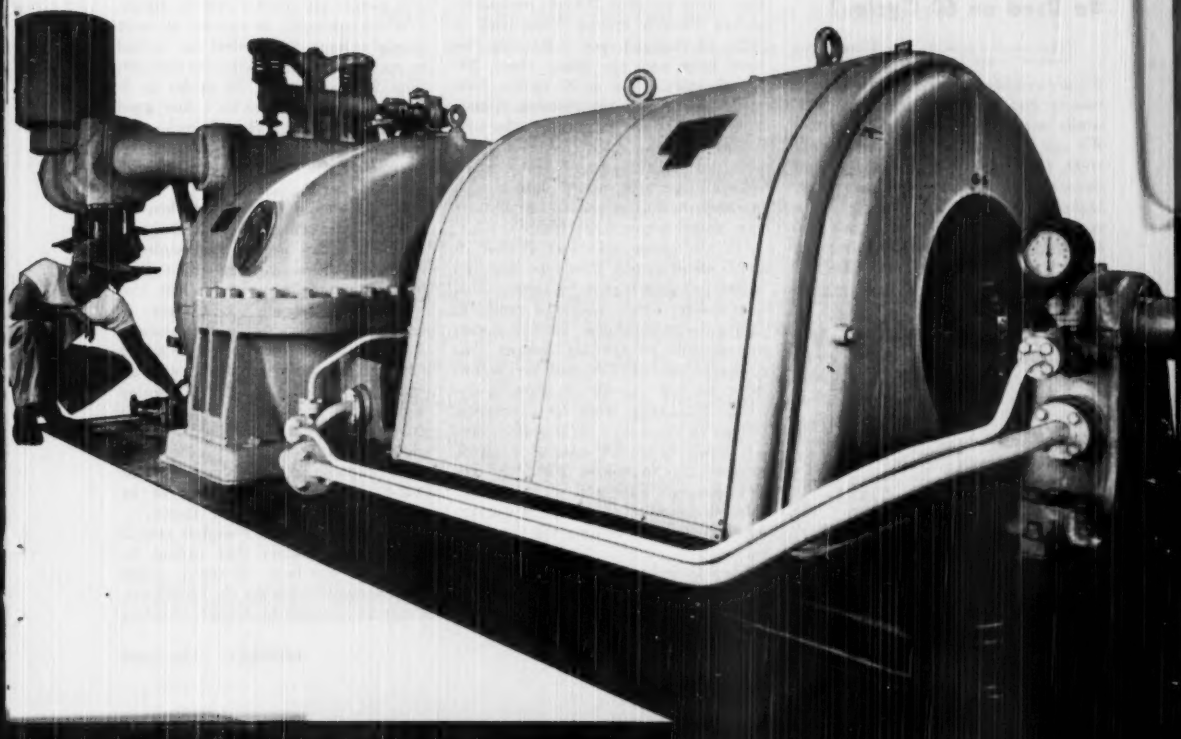
SUN OIL COMPANY • *Philadelphia 3, Pa.*

In Canada: Sun Oil Company, Ltd., Toronto and Montreal

SUN PETROLEUM PRODUCTS

"JOB PROVED" IN EVERY INDUSTRY

SUNOCO



PROBLEMS FROM THE PLANT

THIS MONTH'S QUESTION

Can We Burn Waste Wood and Bunker C?

WE ARE AT THE PLANNING STAGE on a new heating boiler to burn waste wood and fuel oil. Dry-wood shavings and spruce and jack-pine shreddings will account for up to 20% of total fuel required. Remainder will be bunker C oil. Boiler will have a dutch-oven setting with the oil burner placed in the bridgewall.

Our proposed packaged-type, waterwall boiler will have a nominal rating of 8000 lb per hr. It will be designed to work at 200% of nominal rating in winter, to produce 12,000 lb of steam at 80- to 100-psi working steam pressure.

Now here's our problem. We hear it is unwise to combine wood and oil fuels in one boiler. Reason given is we may get a deposit of fused wood-ash on the convector tubes at points where temperatures may be higher than average.

We certainly will value the opinion and experience of POWER's readers on whether we are running a risk in combining these fuels. Then, again, is there any more likelihood of these deposits forming with the oil and wood combination than with the combination of nut slack coal and wood fuels?—*WH*

Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

Readers Answer the March Question

Can 25-Cycle Motor Be Used on 60 Cycles?

(This question from the March issue is followed by best answers from readers.)

We are considering buying used 25-cycle motors and power transformers. Naturally our plant has a 60-cycle system. We can make good use of this equipment, if it is practical to convert both motors and transformers for use at the higher frequency. This 25-cycle equipment would fit into our setup only if it could be reconnected or rewound for 60-cycle operation. We have ruled out the use of a frequency changer as impractical in our case.

That brings up the first question: Can this equipment be used on 60 cycles merely by reconnecting the coil groups (for a motor) or does it call for a complete rewind? If rewinding is the answer will the hp rating remain the same? What about speed, frequency and efficiency? Will the motor operate at the same pf under new conditions?

Perhaps some of POWER's *older readers have run into this problem and found a practical solution. At any rate we are holding off buying till we get an experienced slant.*—LT

It Works: We Did It

FOR YEARS WE USED 25-cycle equipment on our 30-cycle system. Then back in 1926, we changed over to 60-cycle. We have been and are using about 200 transformers, rated at 25 cycles, 2400 to 120/240 v, on our 60-cycle system. They have been entirely satisfactory.

Before changing over we checked with the manufacturer. He claimed voltage regulation would double with the units in 60-cycle operation. But we have never run into this trouble.

On the motor side, our experience shows small motors should be rewound before going to higher frequency. This is necessary since windings generally cannot be reconnected. But we reconnected coils on the big fellows that normally ran at 750 rpm or below. What we did was simply parallel the coils, eliminating need for increasing voltage in proportion to frequency. But *LT* should be mighty careful to check whether the rotor can stand the increased speed. Even now we have many of these reconnected motors in service, which means they've been OK for some 24 years.

We rewound those units that couldn't be used at the increased speeds. This was done at a considerable saving over the cost of new equipment. And pf has been only a few percent lower than with comparable new motors.

We did change the no-voltage release and contactor coils on motor-starting equipment. A little juggling was in order to match correct starters with the reconnected motors operating at the new, higher hp.

Here's an interesting sidelight. In one of our plants, both 30 and 60 cycle are available. By changing from 240 v, 60 cycles, to 120 v, 30 cycles, we operate motors successfully at two speeds. This is a stoker-drive application.

LLOYD F JAYNES *Canon City, Colo.*

Match Motors to Load

LT's 25-CYCLE MOTOR can be used on 60 cycles without any changes, but performance is far different from nameplate rating. If the 60-cycle voltage is the same as rated 25-cycle voltage, note following effects: No-load speed is almost 2.4 times higher; starting and break-down torque are about 1÷2.4 times the 25-cycle hp; full-load speed is slightly less than 2.4 times the rated 25-cycle full-load speed; pf and efficiency drop by a few points.

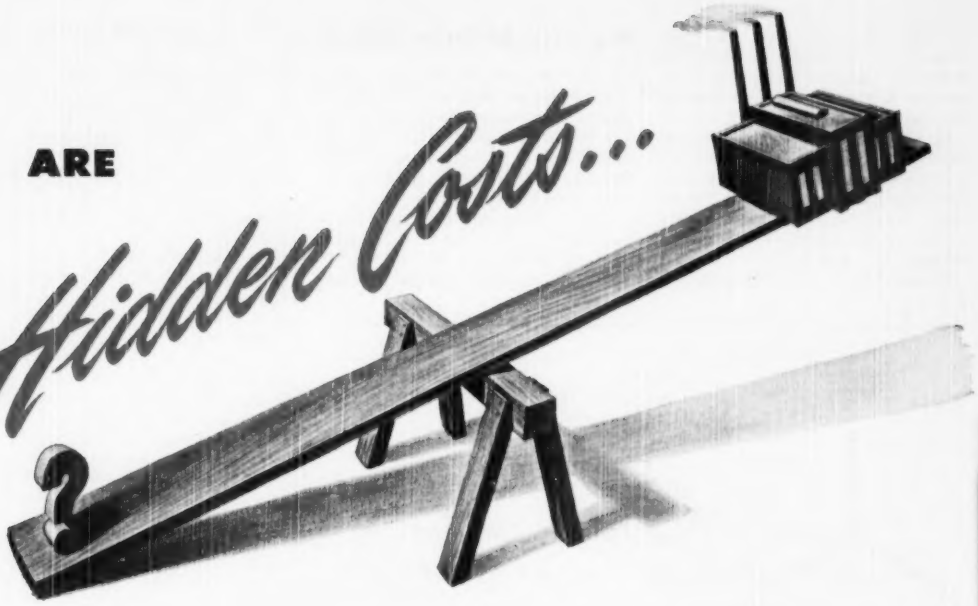
If motors are rated at 440 or higher, it is not advisable to operate at twice normal voltage. Same effect can be had by reconnecting the coils; for instance, from 2-series star at 25 cycles to 2-parallel star at 60 cycles. Any good motor-rewind shop should make the foregoing changes. Check if bearings can operate safely at the new higher speed.

But *LT* should view the problem for applying the motors: What voltage is available? What speeds are required? What kind of load is to be driven (this determines starting and pullout torques)? How much horsepower is needed? Will duty cycle be constant, short time or intermittent? Make a load and available motor tabulation with all characteristics of each. Then, keeping in mind the way motor characteristics change with frequency, as outlined above, *LT* can determine which motors come closest to suiting which load. This can be either without change or by reconnection as mentioned above.

Next step: Consider complete rewind jobs on the motors that cannot be matched to any load. If speed, torque and hp requirements are not too critical, it may be possible to devise a winding

ARE

Hidden Costs...



Keeping Your Plant Efficiency Out of Balance?

Today, as always, costs (hidden or otherwise) are a prime factor in shaping plant operating efficiency. And it's obvious that when efficiency sags, plant operating costs go out of balance. How, then, can *you* best control this "economic see-saw"?

Since water conditioning is a necessary part of efficient plant operation, why not seek ways to make every dollar work harder—with the use of a *correct* water conditioning service designed to help you keep your plant functioning on the profit side year in and year out.

If the results you are presently obtaining are not entirely satisfactory, let us explain how the BETZ specialized water conditioning service can benefit you. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories Limited, Montreal 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

for each motor to be used. If pulleys or gearboxes can be introduced between motor and load to obtain desired speed, problem of designing the desired torque into the winding is simplified.

No changes are necessary in operating 25-cycle transformers at 60 cycles; that is, provided voltage is not increased. Efficiency is somewhat improved at the higher frequency, but voltage regulation is poorer, because of the greater reactance of windings.

NORTON SAVAGE *Dearborn, Mich.*

Buy Used 60-Cycle Motors

LT CAN OPERATE 25-cycle motors and transformers on 60-cycle lines but he'll be wise if he thinks twice before buying. I've converted motors from 25 to 60 cycles several times and find straight 60-cycle equipment, purchased new or used, is easier and safer.

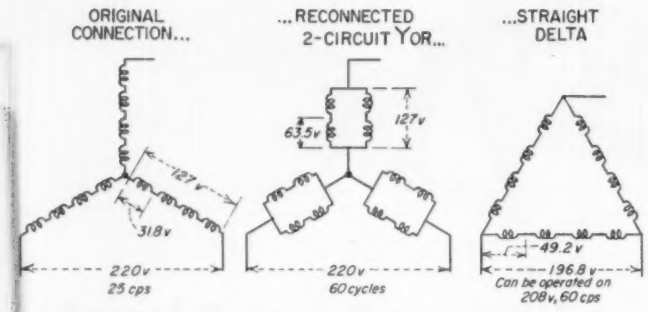
Take a 10-hp motor with 1000-rpm rated speed at 25 cycles as an example. Speed at 60 cycles is 60/25(1000) = 2400 rpm. If applied voltage is jacked up to correspond with frequency (2.4 times voltage at 25 cycles), core flux and coil current are the same. Power is then directly proportional to speed, or 10(2400/1000) or 24 hp. Pf decreases somewhat since motor reactance has increased. Windage and hysteresis losses are somewhat higher, but not large enough to affect operation seriously. Motor cooling is naturally better at higher speed.

When increasing motor frequency, it is generally desirable to keep speed about the same. To maintain constant speed, change number of poles in stator winding. With a frequency change from 25 to 60 cycles, number of poles is usually doubled. It is difficult to get the same speed at the higher frequency without using gears or pulleys. *LT* will probably run into increased vibration if he uses a higher rotor speed. This results from greater windage resistance or improper distribution of coils in the stator winding.

Transformers designed for 25-cycle service are much larger than 60-cycle units with the same output. *LT* cannot, safely parallel his 25-cycle transformers with 60-cycle units and expect proper load division. But if transformers are not banked with 60-cycle units, they are better adapted to frequency change than motors. Copper losses remain almost constant, iron losses decrease, and reactance increases. With unity pf, secondary voltage remains almost the same as on 25 cycles.

As *LT* can see from this discussion, he'll have plenty of problems before his 25-cycle equipment is operating reliably on the 60-cycle mains. Unless he gets 25-cycle equipment at very low cost, he'll be better off buying 60-cycle units.

ROBERT K COLLIER *Summit, N.Y.*



Hold Current Constant Through Coil Groups

WHEN USING 25-CYCLE MOTORS for 60-cycle service it is necessary to weigh changeover cost, lower efficiencies and changed ratings against the cost of motors designed expressly for 60-cycle service.

In a given 3-phase ac motor it is desirable to have the same current flowing through each coil group for a given load regardless of voltage or frequency change. When a 25-cycle motor is to operate on 60 cycles a connection may be selected that would increase the voltage across each coil group about 60 ÷ 25, or 2.4 times. This would hold about the same current in each of the coil groups. Reasoning can be justified since coil reactance is proportional to frequency.

As an example, consider connecting a 750-rpm 25-cycle 220-v 3-phase single-circuit Y motor on 220 v, 60 cycles. One solution is to reconnect the windings two circuit Y. Coil-group voltage is then in ratio of 2:1. Synchronous speed is 1800 rpm; see sketch above.

Since hp varies directly with speed, the hp of our motor is about doubled. Limiting factor in a conversion of this type is the effect of increased rotor speed and core loss. If the rotor speed becomes appreciably more than 7500 fpm, the manufacturer should approve the increased speed. Since the hp rating is increased and load remains the same, the motor necessarily operates at lower pf. Above method is perhaps the simplest way to convert a 25-cycle motor to 60 cycles.

A 25-cycle unit generally has greater starting torque before connecting to 60 cycles than after. This drawback can be reduced by machining the end rings on the squirrel-cage rotor. Rotor resistance will increase, and hence torque.

Here's how to hold hp roughly constant. Since torque varies as voltage-squared, about the same hp can be maintained by making E vary as $(f_1 \div f_2)^{1/2}$. In this case f_1 is the new frequency and f_2 the old. Therefore E varies as $(60 \div 25)^{1/2}$ or 1.55 times original voltage. This can usually be accomplished by changing from star to delta-winding connection, and reducing applied voltage. For example, a star-connected 25-cycle 220-v motor can be reconnected delta and operated on 208 v, 60 cycles. Similarily a 25-cycle 550-v motor can be made to operate on 440 v, 60 cycles. This type conversion is shown above.

If *LT* wants to hold speed somewhat close to the original he must change the number of poles. For example, 25-cycle 2-pole 1500-rpm motor can be regrouped to operate on 60 cycles at 1800 rpm. It is then a 4-pole motor. Regrouping on some motors is mighty tough. So you may have to accept a 2:1 speed change.

G O ELLIOTT *Ontario, Canada*

Well, Maybe . . .

MAJOR HURDLE is difference in motor speeds. This means pole, pulley or gearing change if output speed must be held constant.

Here's pole-speed-frequency relation:

Poles	*Rpm at 25 cycles*	*Rpm at 60 cycles*
2	1500	3600
4	750	1800
6	500	1200
8	375	900
10	300	720

But before going to a higher speed, make sure rotor will stand up under it. Remember, centrifugal stresses increase as square of speed.

I've found that manufacturers discourage operation of 25-cycle equipment

(*Continued on page* 168)

SHAW fills all your piping needs ACCURATELY DEPENDABLY QUICKLY

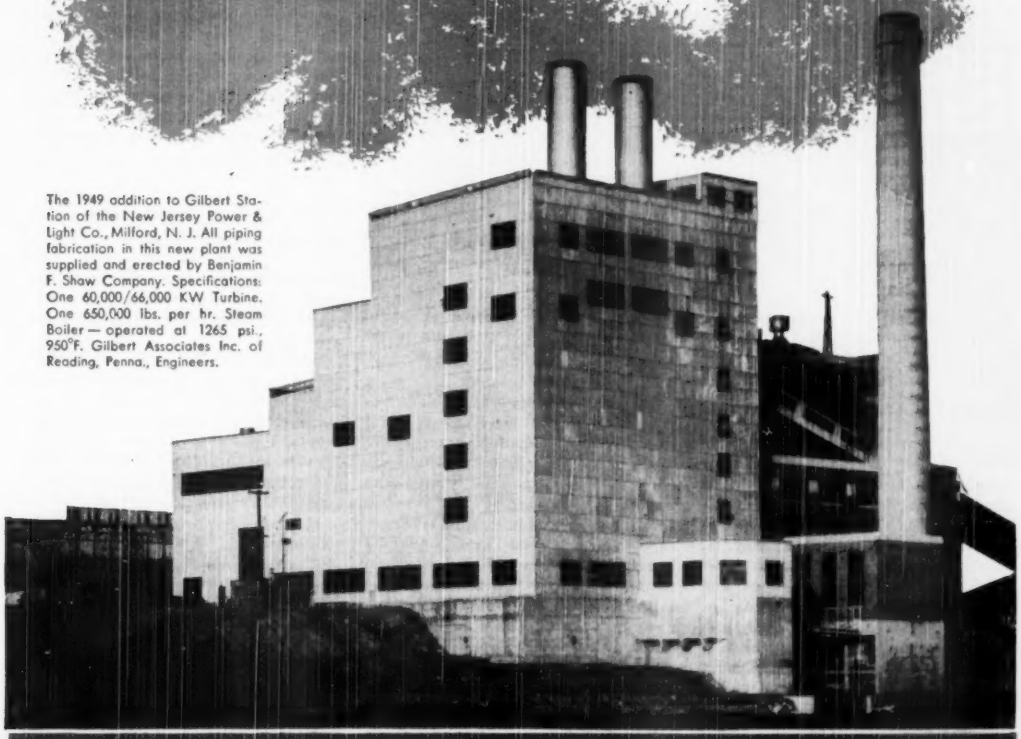
Accurately—due to Shaw's outstanding technical skill and care in testing and checking every step of production. Dependably—because of Shaw's know-how and meticulous analysis of each individual contract. Quickly—through improved production-line techniques and reliable conformance with delivery dates.

Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping throughout the World.

President

BENJAMIN F. SHAW COMPANY

2nd & Lombard Streets Wilmington, Delaware



The 1949 addition to Gilbert Station of the New Jersey Power & Light Co., Milford, N. J. All piping fabrication in this new plant was supplied and erected by Benjamin F. Shaw Company. Specifications: One 60,000/66,000 KW Turbine. One 650,000 lbs. per hr. Steam Boiler — operated at 1265 psi., 950°F. Gilbert Associates Inc. of Reading, Penna., Engineers.

KNOWN SINCE 1893 for HIGH-QUALITY PRE-FABRICATION AND PIPING INSTALLATION

TECHNICAL BRIEFS

ENGINEERING DEVELOPMENT HERE AND ABROAD DIGESTED FOR BUSY POWER MEN

REVIEWED IN THIS ISSUE

POWER-PLANT DESIGN: Developments in High-Temperature and Reheat Turbine-Generators • Trends in Modern Steam-Plant Design • Basic Factors of Steam-Power Station Design • Electric-Power Distribution Systems for Industrial Plants

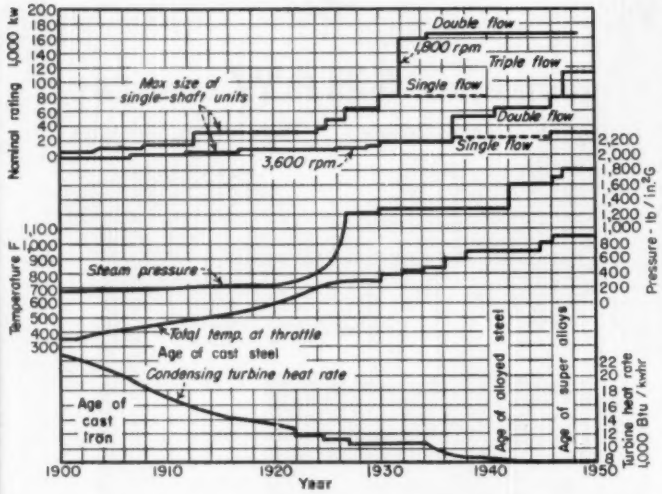
WATER TREATMENT: Experimental Studies of Iron-Oxide Deposits in Boilers • Steel, Heat and Water: Localized Formation of Magnetic Iron Oxide in Power Boilers • Magnetic Iron-Oxide Scale in a 420-Psi Boiler • Prevention of Black Iron Oxides Following Chemical Cleaning

BOILER DESIGN: The Dual-Circulation Boiler: Its Design and Operation for High Makeup Service

ELECTRICITY: Design and Test of Electronic Exciters • Large Electronic Dc Motor Drives in Industry • Liquid Cooling of Ac Turbine-Generators

SMOKE PREVENTION: Flyash Collection for Small Plants • Field and Laboratory Methods of Air-Pollution Study as Set Up in Los Angeles County in California

Directions for ordering papers are given on page 136



1 Progress of higher steam conditions has been closely related to metallurgical developments. Carbon molybdenum and chrome molybdenum steels are recent

Power-Plant Design

DEVELOPMENTS IN HIGH-TEMPERATURE AND REHEAT TURBINE-GENERATOR UNITS, *by J R Carlson, Westinghouse Electric Corp.* Progress of higher steam conditions has been closely related to metallurgical developments, Fig. 1. Along with the development of newer metals — carbon molybdenum and chrome molybdenum steels—there has been an advancement of longer low-pressure end blades for 3600-rpm condensing turbines. Early concern about the operating life of these blades, called on to run at top speeds of over 850 mph, has been answered. Checks have been made on blades that have up to 12 years' duty and they show remarkable freedom from wear.

First turbine using a 23-in. blade was a 100,000-kw unit for Huntley No. 2 Station of the Niagara-Mohawk Power Co. Next step after this installation was the use of steam at 1000 F with inlet pressure of 1650 psig.

Additional gains in thermal efficiency (about 1.3%) came from advancing steam temperatures to 1050 F. Parts in contact with 1050-F steam had to be of austenitic 18-8 chrome-nickel alloy. These parts are throttle valves, steam chests, inlet piping, nozzle chambers.

One serious design problem was supporting and joining dissimilar materials (ferritic and austenitic) and avoiding prohibitive stresses while maintaining accurate alignment. A double-casing design reduced the bolting and thermal problems on both inner and outer casings. Partially expanded steam surrounds the inner casing, reducing pressure differential.

Several installations are described. The values of reheat and the single-shaft 3600-rpm open turbine-generator are discussed. *MWP paper. No number.*

TRENDS IN MODERN STEAM-PLANT DESIGN, *by Paul E Gourden, Ebasco Services, Inc.* The utility industry prides itself, and justly so, on high-quality, reliable service. Continuous achievement of this service is a difficult job in face of mounting investment costs per unit of capacity, and increased fuel, operating and maintenance expenses, as well as limitations on rates for service rendered.

But while all these factors are difficult to live with, they have produced a change in the thinking of power-plant engineers and designers. This thinking has resulted in ideas that make possible some interesting economies where a specific situation permits their application.

Because of the excellent availability record built up by modern boilers, they are installed on the basis of one per turbine with every assurance that they will prove as reliable as the turbine. In multiple installations no interconnections are used. Both ideas effect considerable savings.

The outdoor plant is another fairly recent entry. It offers obvious construction savings. *MWP paper. No number.*

BASIC FACTORS OF STEAM POWER-STATION DESIGN, *by B C Mallory, Stone & Webster Engrg Corp.* This paper presents analyses of studies covering basic design features for recent high-pressure, high-temperature steam-power installations. Behind the analyses is an explanation of the designs chosen.

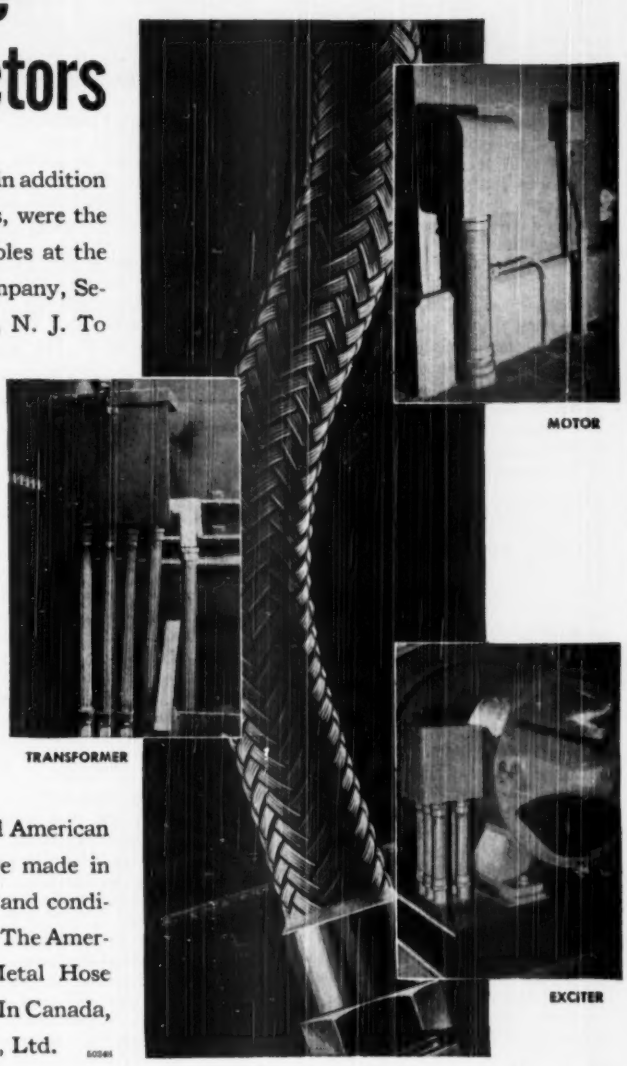
To reach a suitable design requires a detailed investigation of the economics

Generating Station "Makes Ends Meet" with Flexible Connectors

Moisture and mechanical protection, in addition to flexibility at terminal connections, were the primary considerations for some cables at the Public Service Electric and Gas Company, Sewaren Generating Station, Sewaren, N. J. To meet these requirements American Seamless Flexible Metal Tubing was chosen by the design engineers of this utility.

American "Seamless," in addition to being 100% water-tight, has several "plus" advantages. Alignment ease at rotating units, junction boxes and other equipment simplifies on-the-job installation. Savings in construction costs are an added premium obtained along with the flexible connection provided.

American Flexible Metal Hose and American Seamless Flexible Metal Tubing are made in types for a wide variety of services and conditions. For information, please address The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada, The Canadian Fairbanks-Morse Co., Ltd.



MOTOR

TRANSFORMER

EXCITER

ANACONDA
from mine to consumer

wherever connectors must move . . . ***American***

FLEXIBLE METAL HOSE AND TUBING

of available equipment and a careful consideration of probable operating conditions.

The author produces several charts. One shows a comparison between reheat and non-reheat turbines for 1250-psi 950-F initial steam, and reheat to 950 F. The chart indicates return on incremental investment for different load factors and for different fuel costs. While reheat has a cycle efficiency of 5 to 6% better than a straight-through unit at full load, the advantage decreases as load falls off. Several examples are cited to show where reheat does and does not apply.

Second feature is a comparison between "skyscraper and ranch-house construction." By this the author means fairly low construction with elements spread out (ranch house) as against elements placed one above the other or at raised elevations (skyscraper).

Next, he reviews the trend of power plants to employ one boiler, one turbine design, elimination of cross connections, growth of centralized control. *MWP papers. No number.*

ELECTRIC-POWER DISTRIBUTION SYSTEMS FOR TYPICAL INDUSTRIAL PLANTS, *by S L Chapin, Sargeant and Lundy, engineers.* When planning a distribution system for any plant the following basic conditions must be considered: (1) type of industry (2) amount of load to be handled (3) importance of uninterrupted service and (4) plant area.

With this information on hand a study can be made to decide the following: (1) scheme of distribution (2) location of distribution centers (3) best voltage to use.

Author has followed the above outline in tackling several types of installations. Covered are the problems that cropped up in development of the systems and the way they were handled. A paper-board mill, large educational institution and steel mill were taken as fitting subjects.

Conclusion is that each installation is an individual problem that defies standard formula. Hence the need for the basic approach outlined in first paragraph. *MWP paper. No number.*

Water Treatment

EXPERIMENTAL STUDIES OF IRON-OXIDE DEPOSITS IN BOILERS, *by Clarence Jacklin and Harris Thompson, National Aluminate Corp.* Iron-oxide deposits in steam generators and, in severe cases, tube failures from this form of deposit have occurred in the field. Some have been well reported with recommendations for their correction.

But the biggest problems in knowing what happens in the field are (1) occurrence of unavoidable variations in operating conditions and (2) control of all factors at the desired level while varying the single factor under study.

An indication of the need for isolating the factors is the questions that exist on how iron-oxide deposits occur. Some believe iron enters the boiler with feedwater and then adheres. Others say it is iron corroded from any area in the boiler and carried by circulation to a high heat-transfer spot and deposited there. Still others claim the deposits occur solely as a result of high heat transfer.

Further, it is desirable to know whether rapid attack and failure results from the insulating action of the deposits, firing conditions that produce intermittent or continuous water-starved areas with resulting concentration of boiler-water solids at the metal heat-transfer surface, or a combination of deposits and high heat transfer.

The author describes investigations to answer these questions from laboratory research. Equipment used, methods of heating and test conditions are outlined. Test results are also given. *MWP paper. No number.*

STEEL, HEAT AND WATER: LOCALIZED FORMATION OF MAGNETIC IRON OXIDE IN POWER BOILERS, *by H M Rivers and W M Sonnett, Hall Laboratories, Inc.* Iron in contact with boiler water tends to corrode spontaneously. Water decomposes in the process, liberating hydrogen gas and producing magnetic iron oxide (Fe_3O_4) as the main corrosion product. Because it is very insoluble the iron oxide normally precipitates directly on the metal to form a tightly adherent barrier that stops further corrosion.

Prevention of corrosion in boilers is mainly a problem of keeping the natural oxide coating intact. If corrosion develops the protective film has apparently broken down. Mechanical, chemical or other factors may cause the trouble.

Erosion or sudden temperature changes illustrate physical or mechanical causes. Dissolved oxygen, galvanic forces set up by porous or lightly adherent deposits, strong concentration of boiler-water caustic, exposure to superheated steam at very high temperatures are examples of chemical causes.

This paper presents case histories of four types of corrosion attacks: concentrating film corrosion, attack under adherent deposits, hydrogen damage, gouging caused by steam blanketing. Other types are mentioned, all carefully selected to develop a coherent picture of corrosion mechanisms responsible for localized formation of magnetic iron oxide in power boilers. *MWP paper. No number.*

MAGNETIC IRON-OXIDE SCALE IN A 420-PSI BOILER, *by John H Moore, Otter Tail Power Co.* The phenomenon of magnetic iron-oxide and copper scale deposits has not been common in boilers operating under 600 psig. The author's company, however, experienced this phenomenon at 420 psig.

Condensate and feedwater system at this plant is a closed one, originally designed with no deaeration other than that in the main condenser. Raw water comes from the Otter Tail River through a system of lakes and man-made channels that aerate the water. Heavy growths of weeds and grass contaminate the water with gases from decaying algae growths. Traces of ammonia and silica are also found.

The station went into service Aug 31, 1948. The unit operated as constantly as possible—72% average capacity factor for months ending April 30, 1949.

Magnetic iron-oxide traces showed up in the blowdown by late fall of 1948, and kept increasing. But nothing was done in the hope the whole problem could be solved during the scheduled June outage. On May 10 a tube leak developed, followed the next day by another and a blister on a third tube.

When the unit was pulled out of service, deposits were found in all side waterwall tubes at the lower ends. So all side and rear walls were turbined. The author discusses the steps taken at this time and after the June outage.

(Continued on page 138)

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from one of the following sources:

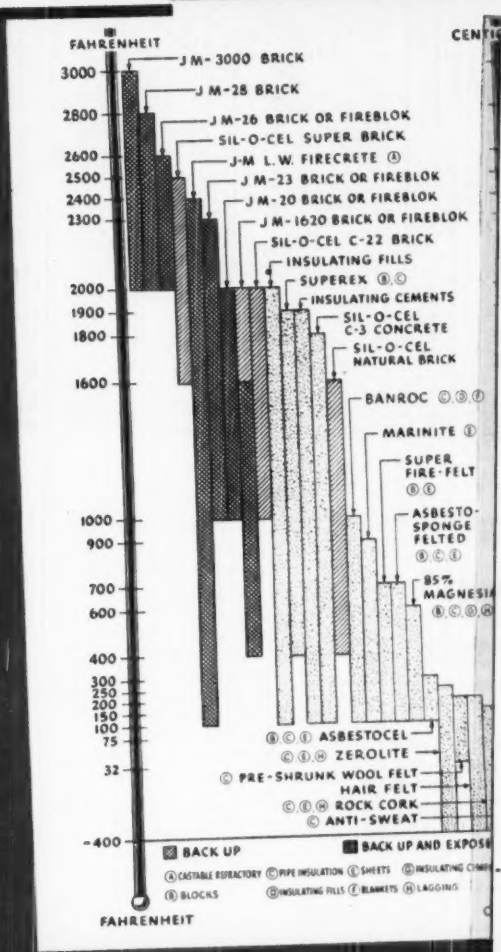
American Institute of Electrical Engineers, winter general meeting, New York, N. Y. Jan 30-Feb 3, 1950. Papers are identified by initials AIEE. Obtainable through AIEE, 29 W 39th St, New York 18, N. Y.

Midwest Power Conference, annual meeting, Chicago, Ill. April 5-7, 1950. Papers are identified by initials MWP. Obtainable in proceedings ($3) from E R Whitehead, Secy, Illinois Institute of Technology, 3300 Federal St, Chicago 16, Ill.

American Society of Mechanical Engineers, spring meeting, Washington, D. C. April 12-14, 1950. Papers are identified by initials ASME. Obtainable through ASME, 29 W 39th St, New York 18, N. Y.

Ready reference chart...

Johns-Manville THERMAL INSULATIONS



Yours... for better insulation service!

Now, you can see at a glance the recommended insulation for every temperature range, from minus 400F to plus 3000F.

It's all on this convenient Johns-Manville Thermal Insulation Chart (11½" x 18") available for hanging in your office or on your plant wall.

Each insulation in this group of Johns-Manville products is tailor-made to do a specific type of job *best*. And, as part of the Johns-Manville Insulation Service, specialists are available to help you with present insulation problems . . . or with those connected with future plans.

By having these men select and apply Johns-Manville insulations, you will be dealing with men who have grown up in the business. You'll find that it will pay, in the long run, to have these experts help you... *because they have to their credit more man-hours of insulation application experience than all other similar types of organizations combined.*

For your copy of this chart, just fill in and mail the coupon below.

FOR EVERY TEMPERATURE JM **EVERY**

Johns-Manville
Box 290
New York 16, N. Y.

Please send me copy of Johns-Manville Insulation Chart IN-6D.

Name_____

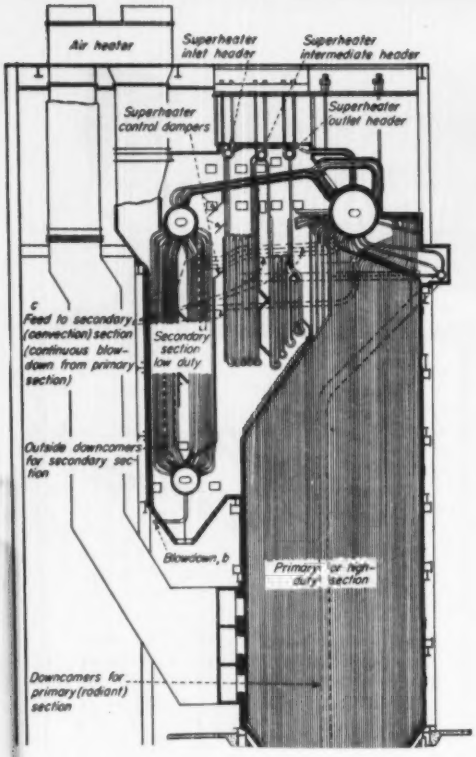
Title_____

Company_____

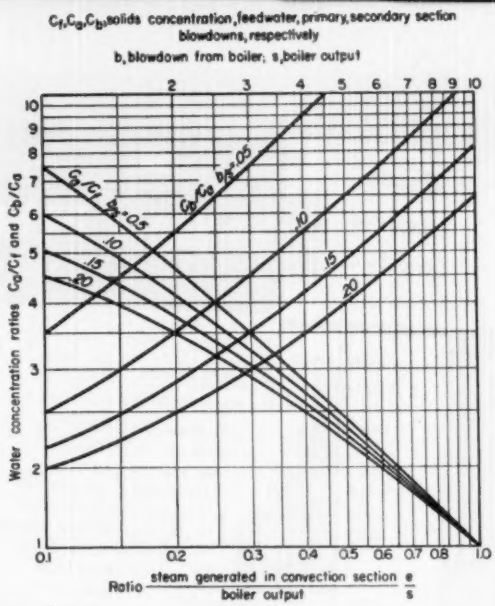
Address_____

City_____ State_____

P-



2 Dual-circulation boiler, *left*, employs principle of stage evaporation, using two separate heat-absorbing sections


C_f, C_c, C_b, solids concentration, feedwater, primary, secondary section blowdowns, respectively
b, blowdown from boiler; s, boiler output
Water concentration ratios C_c/C_f and C_b/C_c
C_c/C_f b/s=0.05
C_b/C_c b/s=0.05
10
15
20
Ratio $\frac{\text{steam generated in convection section}}{\text{boiler output}} \frac{e}{s}$

3 Concentration in separate sections depends on steam generated, amount of blowdown. Graph shows allowable ratio

In addition, the pre-boiler system is described and discussed. The author feels that their magnetic iron-oxide scale troubles had their origin in this part of the system. *MWP paper. No number.*

PREVENTION OF BLACK IRON-OXIDE DEPOSITS FOLLOWING CHEMICAL CLEANING, *by P H Cardwell, Dowell Inc.* After normal procedure for acid-washing of boilers for removing iron oxides and sludge, a black iron-oxide film has been found on the internal surfaces. This film seems to form from contact with air during the drainage step for cleaning, alkaline wash and rinse.

This paper reports investigations to find ways of preventing the iron-oxide-film formation. Sections of boiler tubes cut into rings were cleaned in acetone and suspended in acid, alkali and rinse solutions to simulate, as closely as possible, the usual method used to acid-clean a boiler. In the second test all solutions were drained by displacing them with water to prevent the metal coming in contact with air. Third test used nitrogen as the displacing fluid to keep air away from the metal.

Another series of tests investigated the value of various chemicals that would remove the iron-oxide film following the water rinse. The paper contains several tables showing the results of numerous laboratory tests, as well as actual cleaning operations on boilers in the field. *MWP paper. No number.*

Boiler Design

THE DUAL-CIRCULATION BOILER: ITS DESIGN AND OPERATION, *by R A Lorenzini, Foster-Wheeler Corp.* The dual-circulation boiler grew out of the need to use high-pressure boilers where make-up ran high. Despite the unfavorable feedwater condition, industrial plants in particular were anxious to reap the advantages of steam generation at high pressures and temperatures. Dual-circulation boiler permits a maintenance of low concentration for any given blowdown in that section of the boiler most intensely heated which releases steam.

This new-design boiler employs the principle of stage evaporation. Two separate heat-absorbing sections are provided, Fig. 2. Each has its own independent circulating system. This is the same as two separate boilers in one setting where blowdown from one section constitutes the feed for the second.

In the first or primary section, concentration is maintained at a much lower value than in the secondary one. So even when concentration in feedwater and makeup runs high, the primary or center section can be safely placed under high rates of heat absorption, much higher than in the secondary.

Ratio of concentration in the two sections depends on the amount of steam generated in each section and the amount of blowdown from the secondary section. Fig. 3 shows a graphical representation of concentration ratios for various proportions of secondary-section steam-generation and boiler output, and for different rate of blowdown from the unit. This graph shows that for ratios of steam generation ranging from 0.2 to .4, as customarily happens, concentration in the high-duty section is not greatly affected by changes in blowdown rates. This is a most desirable feature and makes precise control of blowdown unnecessary.

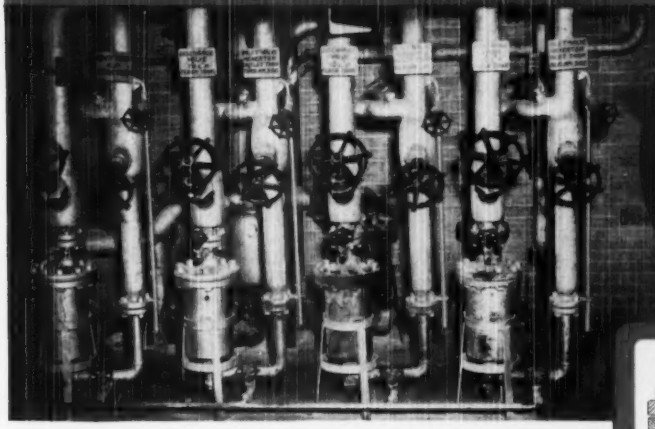
The author continues to discuss the design features of the new unit and its operation and performance. A number of excellent illustrations showing both test and operating data are supplied. *MWP paper. No number.*

Electricity

DESIGN AND TEST OF ELECTRONIC EXCITERS SUPPLIED FROM COMMON-SHAFT DRIVEN GENERATORS, *by A P Colaiaco, A A Johnson and J E Reilly, Westinghouse Electric Corp.* Rectifier tubes have demonstrated their reliability from many years' service in industrial application and, to a limited extent, on

(*Continued on page* 158)

FORGED STEEL steam traps



List of Materials

CAP and BODY FORGINGS:*
Up to 400 psig—S.A.E. 1030 steel
600 to 900 psig—ASTM F-1 moly-steel
900 to 1500 psig—ASTM F-7 chrome moly-steel

VALVE AND SEAT:
Chrome steel, heat treated

BUCKET and VALVE LEVER ASSEMBLY:
18-8 Stainless Steel

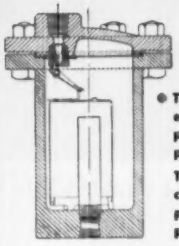
BOLT and NUT SET:*
Bolts Class C, 125,000 lbs. tensile
Nuts, hex, semi-finish, S.A.E. 1030

GASKET:*
Compressed graphited asbestos

*Does not apply to No. 3211 nor No. 913

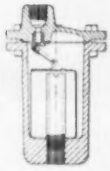
1. FOR HIGH PRESSURE SERVICE — engineers responsible for the design or operation of high pressure, high temperature steam plants can specify with confidence Armstrong Forged Steel Steam Traps to provide completely automatic condensate drainage throughout. These traps are "standard" in leading power stations throughout the entire world where they are used for draining headers, desuperheaters, soot blowers and other drip points at pressures as high as 2400 psig! These traps always open when filled with condensate and there is no steam loss under no-load conditions. Safety and dependability are assured through use of modern materials, highest quality workmanship and critical inspection.

2. FOR ALL-STEEL INSTALLATIONS — Armstrong Forged Steel Traps also ideally meet the increasing demand in power plants, refineries and general industry for all-steel fittings on lower pressures (up to 250 psig) because they are light in weight and surprisingly low in price. They provide the maximum in safety, dependability, shock and fire resistance.

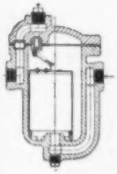


● **Traps with screwed connections for pressures to 900 psig.**

Traps with flanged connections for pressures to 2400 psig.



● **No. 3211 trap for pressures to 250 psig, only $14.00.**



● **Side inlet cast steel trap for pressures to 600 psig, screwed or flanged connections.**

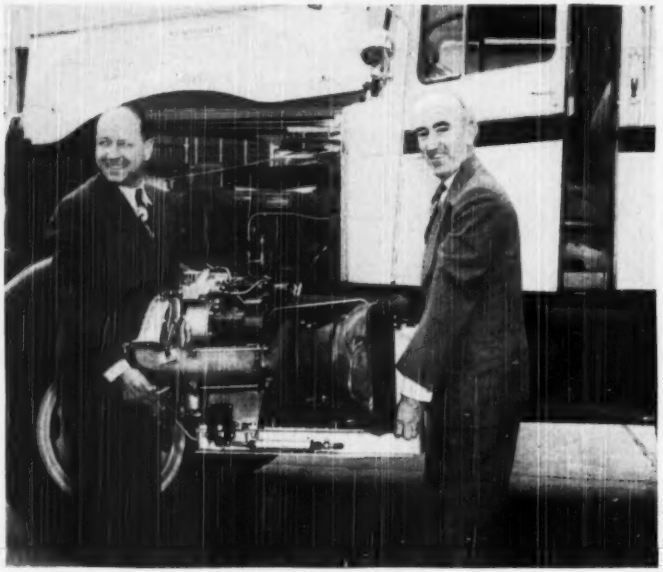
● FOR COMPLETE DATA ask for the 36-PAGE ARMSTRONG STEAM TRAP BOOK or see our catalog in Sweet's.

ARMSTRONG MACHINE WORKS
812 Maple Street, Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS



First Gas Turbine Hits U.S. Highways

World's first gas-turbine-powered truck successfully underwent road tests at the Boeing Airplane Co, Seattle, Wash. The 200-lb 175-hp unit described in *Power* January 1950, pp 98 to 101, runs a 10-ton truck. J G Holstrom, *left*, vice-pres, Kenworth Motor Truck Corp, and W M Allen, Boeing president, lift one of the units.

COMING EVENTS

June 7-9—Wisconsin Power Conference and Exposition, Schroeder Hotel, Milwaukee, Wis. Walter W Roock, secy, 3430 W Forest Home Ave, Milwaukee 15, Wis.

June 9-10—New York State Convention and Power Show, National Assn of Power Engineers, Hotel New Yorker, New York, N. Y. W G Graepel, secy, Long Island Hospital, Brooklyn, N. Y.

June 12-16—Oil and Gas Power Div, 22nd National Conference and Exhibit, American Society of Mechanical Engineers, Lord Baltimore Hotel, Baltimore, Md. O B Schier, secy, ASME, 29 W 39th St, New York.

June 19-23—American Society of Mechanical Engineers, summer meeting, Hotel Statler, St. Louis, Mo. O B Schier, secy, ASME, 29 W 39th St, New York.

July 17-19—Universal Craftsmen Council of Engineers, 46th annual convention, Hotel Statler, Boston, Mass. Dudley G Kimball, chairman, 55 Clifton St, Boston 25, Mass.

August 15-19—National Association of Power Engineers, 49th annual power show and convention, Hotel Jefferson, St. Louis, Mo. A F Thompson, secy, 176 W Adams St, Chicago, Ill.

Air Pollution: City, State or Federal Problem?

► THERE NEED BE no question but that Uncle Sam is interested in atmospheric pollution after the first government-sponsored conference on air pollution held in Washington, D. C., May 3-5. This conference, officially called the United States Technical Conference on Air Pollution, was proposed by the President several months ago. An interdepartmental government committee was set up by Secretary of the Interior Oscar L Chapman, with its chairman, Dr L C McCabe, chief of the recently established U.S. Bureau of Mines' Office of Air and Stream Pollution.

About 80 papers were presented. They covered all phases of air pollution including its effect on cancer and respiratory diseases. In addition to the scientific phases, the legal aspects were considered and discussed. Seven separate panel discussion groups were scheduled. They included health, meteorology, instrumentation, equipment, analytical methods and properties, legislation, agriculture.

Nearly 250 scientists and government experts on air pollution convened to discuss various problems.

Among the legal problems was the national aspects of atmospheric pollution legislation and industrial considerations of air-pollution regulations. So much for federal interest.

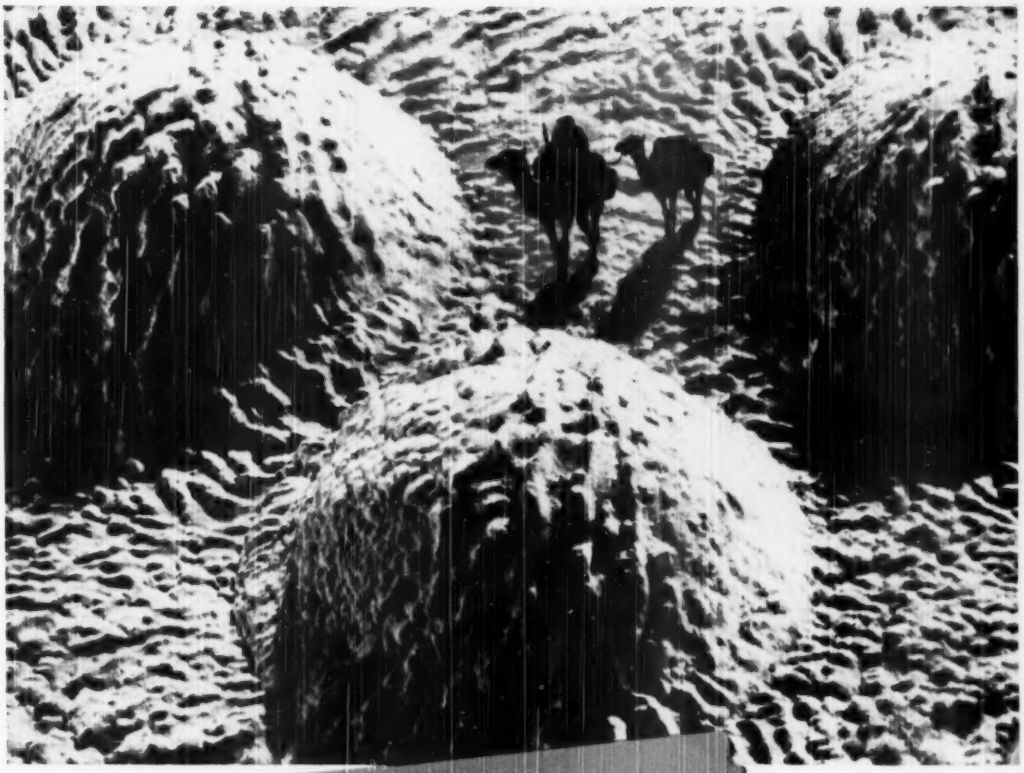
The state of Pennsylvania has started a program that may well prove a forerunner of things to come in other states. It has placed on the road a mobile laboratory, equipped with the necessary sampling and testing devices to run on-the-spot checks on atmospheric pollution in any community in the state.

This mobile laboratory is a part of the new Pennsylvania State Air Pollution Div of the Industrial Hygiene Bureau. The division, according to Governor James H Duff, is to "do everything possible to prevent another smog tragedy like the one that claimed the lives of 22 persons in and around Donora in 1948."

1,000,000-Hp Hydro Turbine Contract Let

Recently the Newport News Shipbuilding & Dry Dock Co was awarded a contract for ten 100,000-hp turbines to be installed in the Chief Joseph hydroelectric plant being built on the Columbia River in Washington. It is about 50 miles below Grand Coulee plant, which is now nearing completion

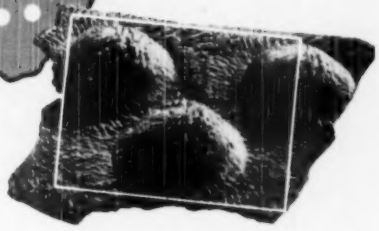
(*Continued on page* 204)



Desert Waste...

THIS "desert" was formed under water—improperly treated boiler water. It represents needless waste in several ways... Boiler down time... Overheated drum and rivet metal... Loss of heat transfer efficiency... Sluggish response to load changes.

Since the scale was removed, The Nalco System has kept the boiler clean-to-metal and corrosion-free continuously—and economically. Where conditions require uninterrupted boiler operation, The Nalco System can also be utilized to remove old scale, as well as prevent new deposits. Either way, The Nalco System is your assurance of *permanent water treatment results.* Write for prompt action on your problems.

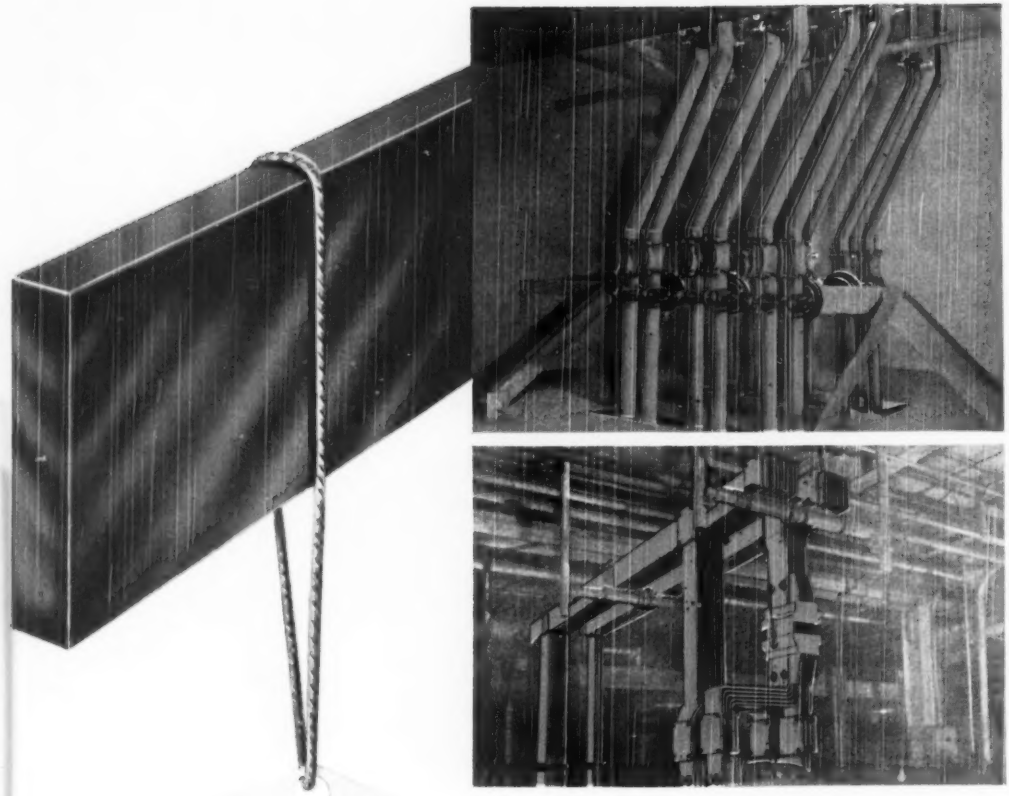


Rectangle in small photo shows area of scale sample in large illustration. "Hills" are scale-covered rivet heads. Approximate size of sample: 7" x 5". *Nalco Laboratory photo.*

NATIONAL ALUMINATE CORPORATION
6222 West 66th Place
Chicago 38, Illinois

Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario

THE *Nalco* **SYSTEM** • **Serving Industry through Practical Applied Science**



REVERE
really knows
BUS BAR

BECAUSE of its superior electrical and heat conductivity, Revere Bus Bar is your logical choice for bus connections, switch and panel boards, circuit breakers and power feed systems in general. No other commercial metal approaches electrolytic copper in its ability to carry electricity. Having the highest thermal conductivity of any commercial metal, copper offers the greatest ease of cooling. Furthermore, joints of high electrical conductivity are readily made by soldering, brazing, or bolting. Because of its low coefficient of thermal expansion, copper bus bar minimizes design difficulties in providing for changes in length due to temperature changes. An added advantage: high scrap value of the metal when plant changes necessitate a new system of buses. For information on Revere Bus Bar, consult the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

• • •

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

Announcing the NEW

JENKINS SWINGTITE

with an exclusive new design that assures smooth action, positive closure, and longer life

Fast-Action Bronze Gate Valve

125 lbs. Steam
300 lbs. O.W.G.

In the new Jenkins SWINGTITE Fast-Action Bronze Gate Valve, the exclusive rolling disc and guide track design lengthens valve life and assures maximum tightness as it prevents uneven wear of seating surfaces. As the valve is opened or closed, guide rims around the seating surfaces of discs roll freely over guide tracks cast in the body, distributing wear evenly, dislodging foreign matter, and providing a polishing action for seating surfaces.

The SWINGTITE can be opened or closed instantaneously and easily with less than a quarter turn of the malleable iron lever which activates the self-adjusting ball and socket type double disc.

Wherever full, free flow is essential . . . where valve opening or closing must be instantaneous . . . you will see more and more Jenkins SWINGTITE Bronze Gate Valves setting new standards of performance and endurance. They are recommended especially for such services as laundry machinery, dish-washing equipment, gasoline and fuel oil lines, fire extinguishing steam lines in kitchens, and dispensing lines to tanks or vats.

Get all the facts on the new Jenkins SWINGTITE. Find out how much smoother-operating, how much *longer-lasting* these fast-action Bronze Gate Valves can be when *Jenkins* builds them. Send for the new folder, Form No. 196, containing full details. Jenkins Bros., 100 Park Avenue, New York 17, N.Y. Jenkins Bros., Ltd., Montreal.

Sold through leading Industrial Distributors

NO OTHER VALVE of its type HAS THIS FEATURE

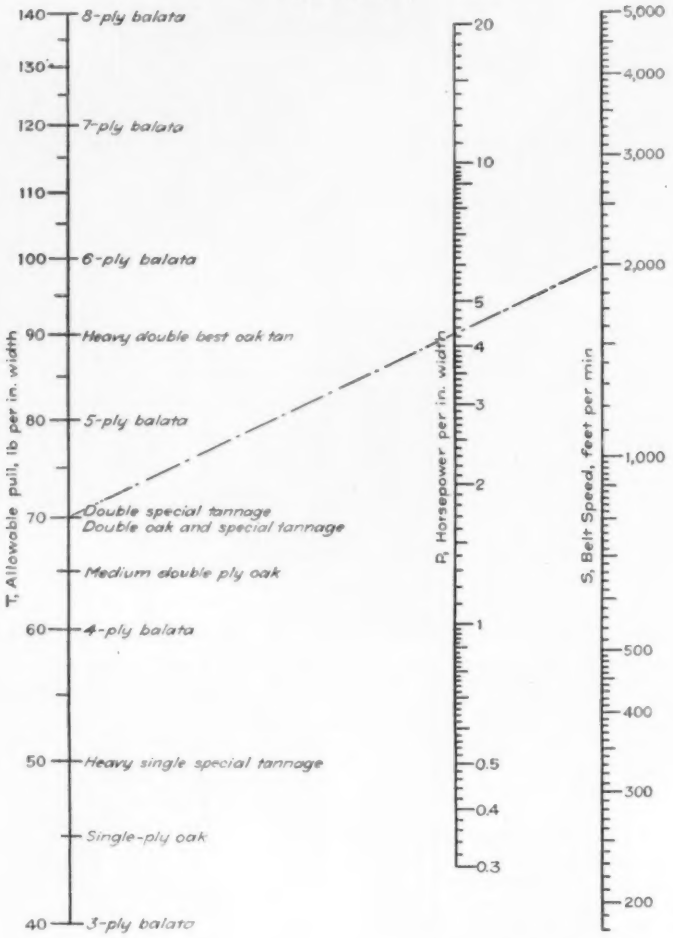
Notice the guide rims (A) of the discs which rotate freely on the guide tracks (B) cast in the body, as the valve opens or closes. This roller action provides a self-cleaning and polishing effect, and also distributes the wear, since the seating position of the discs changes with each closing. Rapid, uneven wear is prevented, and continuous tight closure assured.

JENKINS VALVES

FOR OVER 100 YEARS THE DIAMOND MARK

TRADE JENKINS MARK

Number 216



Figuring Horsepower Ratings of Belting

► MANUFACTURERS SPECIFY the allowable duty of belting they produce. Horsepower transmitted depends on maximum permissible pull and the speed at which the belt runs. This can be determined by the nomogram based on the formula:

$$\text{Hp} = \frac{T \times S}{33{,}000}$$

where:

T = allowable pull, lb per in. width

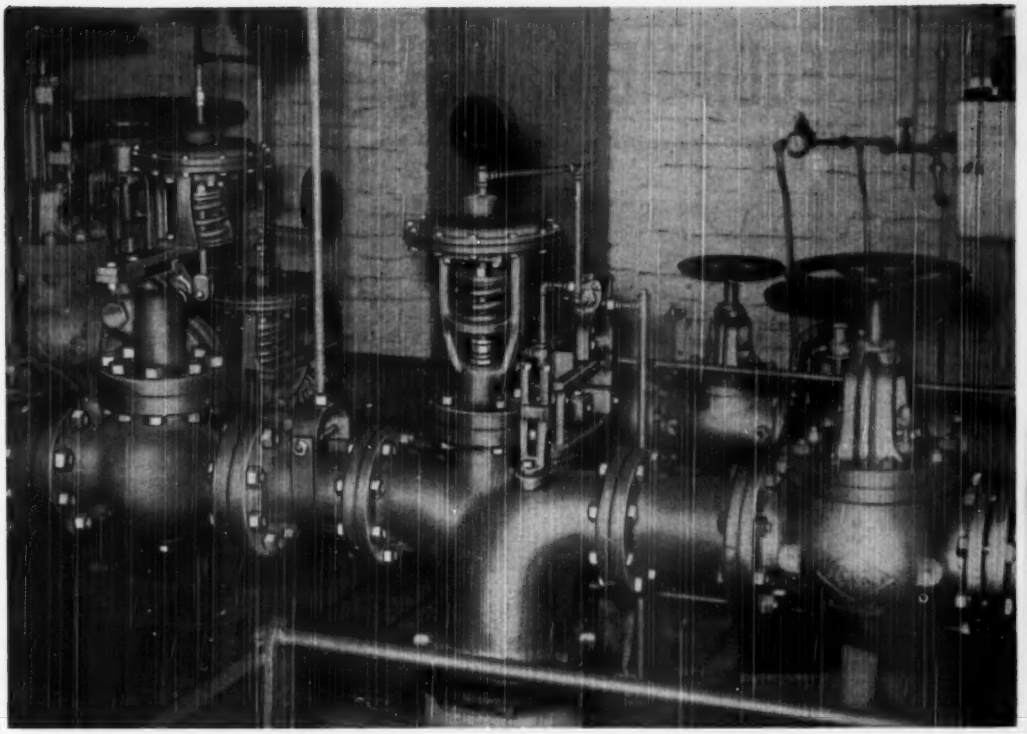
S = belt speed, ft per min

Chart gives the allowable pull for a few of the leather and balata belts often used.

Example: Find the horsepower that can be transmitted by a 24-in. belt traveling at 2000 ft per min. Belt can be worked with an allowable pull of 70-lb-per-in. width.

Lay a straightedge from 70 on the left-hand scale to 2000 on the right-hand scale to find 4.25 hp on the center scale at the intersection with the line. Total hp for 24-in. belt = $4.25 \times 24 = 102$ hp.

BY JOHN F HYAM, *Sarnia, Ontario*



Close, quiet control of reduced steam pressure and temperature

When it comes to your pressure reducing and desuperheating station, you will find COPES engineers talk your language. They design and size your station to give precise, noise-free control for years to come.

IN THE PICTURE . . .

COPES Pressure Reducing and Desuperheating Station handles up to 25,000 pounds of steam per hour from 450 psi and 509 F to 220 psi saturated. Pressure and temperature are held within close limits demanded for efficient operation of process equipment.

Thus you avoid high velocities, vibration, "chatter" and wear. Your final pressure and temperature are not upset by "hunting"—but hold within the limits you specify.

Your reducing valve has a high lift to equalize wear over more of the piston area, increasing service life. Your Desuperheater completely atomizes the cooling water, even at the lightest flows.

Bulletin 477 tells the story of these accurate, *quiet* controls. Write for your copy—now.

NORTHERN EQUIPMENT CO.
601 Grove Drive, Erie, Pa.

BRANCH PLANTS: Canada, England, France, Austria, Italy. *Representatives Everywhere*

COPES

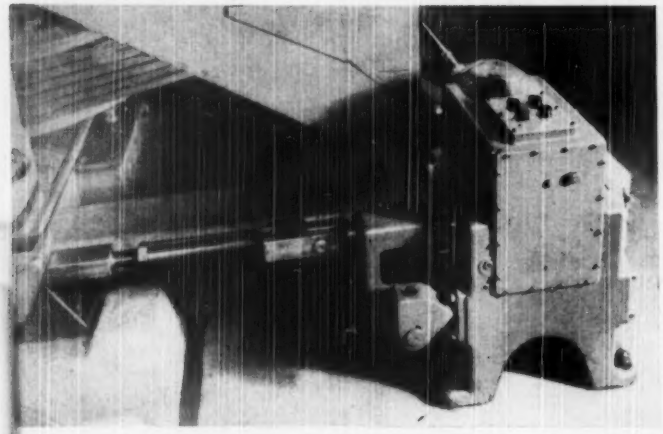
Headquarters for . . .

Boiler Feed Water Control . . . Excess or Constant Pressure Control, Steam or Water . . . Liquid Level Control . . . Balanced Valves . . . Desuperheaters . . . Boiler Steam Temperature Control . . . Hi-Low Water Alarms.

PLANT EQUIPMENT NEWS

Published monthly as a service to readers

Your information center for new products to solve plant problems. Spot what you need, use handy cards to request more details



HYDRAULIC-TURBINE GOVERNOR

P600 • Type PG-500 governor for small hydraulic turbines, either francis or impulse, where the smallest size governor previously available has been too large and expensive. Governor is equally adaptable to larger internal-combustion engines, steam engines and steam turbines, where the largest available self-contained governors have not had sufficient capacity to handle the energy-control means satisfactorily.

This governor is the hydraulic type, using oil pressure as an operating medium. Entire governor is enclosed in a cast-iron case, and arranged for installation on the powerhouse floor at a location best suited to drive and gate connections.

Oil pressure for operation is obtained from a self-contained gear pump connected to the governor drive, either by V-belts or synchronous motor, depending on turbine arrangement and the way the drive can be most satisfactorily used.

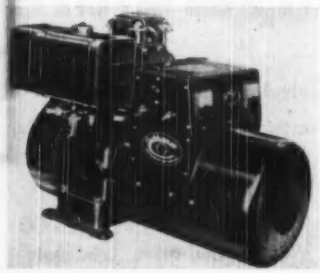
Speed-sensitive element consists of two pairs of flyballs, opposed by a spring, and connected to governor drive. An automatic compensating mechanism is provided to prevent hunting.

Governor has a capacity of 500 ftlb at an operating pressure of 200 psi. It is capable of making a complete stroke in a minimum time of one and one-half seconds, if desired.

Following controls are furnished as standard equipment and are grouped on a control panel on top of the governor case: (1) Manually operated speed changer enables generator to be synchronized with other machines, adjust its load and adjust frequency. (2) Speed droop, adjustable from zero to 5%, enables generator to be paralleled with other generators. (3) Gate-limit adjustment permits gates to be blocked at any desired opening, or if turned toward the zero position, closes gates completely or partially, as desired. This control is provided with a convenient scale for reference purposes. (4) Gate position indicator shows actual opening of the gates.

Certain auxiliary controls are also available such as: (1) synchronizing motor, to provide remote control of speed adjustment (2) automatic shutdown device, which can be actuated by a pushbutton, relays, etc.

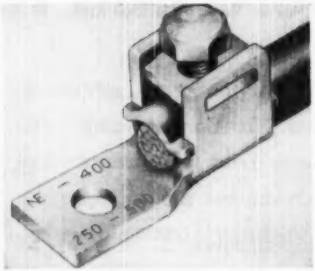
Woodward Governor Co, Rockford, Ill.



MOBILE POWER PLANT P648

Cyclohm power plant has 4-cycle single-cylinder L-head-type engine, air-cooled by a flywheel blower. Units are available in sizes from 350 to 2000 watts, both ac and dc. Automatic reverse-current cutout prevents battery discharging through unit when generator voltage falls below battery voltage. Power plant is suitable for mobile and emergency service.

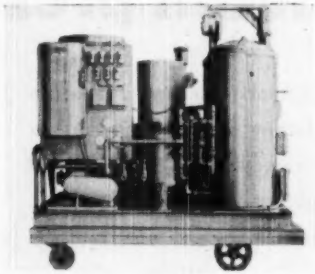
Cyclohm Motor Corp, 11-46 Road, Long Island City, N.Y.



WIRE CONNECTORS P655

Five lug models for use with copper, aluminum or steel wire in sizes from 14 AWG to 500 mcm. These pressure connectors are complete assemblies, thus eliminating loose washers or parts. Three smaller sizes, NE 35, 60 and 100, can be installed with screwdriver while larger sizes NE 200 and 400 call for a wrench.

National Electric Products Corp, Chamber of Commerce Bldg, Pittsburgh 19, Pa.



OIL-PURIFYING SYSTEM P650

Designed to eliminate acidity, moisture, sludge, and to restore dielectric strength in insulating oils. System consists of dual purifiers, heat exchanger, dehydrating and degasifying unit, electrical-control panel, pumps and motors. Entire assembly is mounted on a dolly for ready transportation and handling.

Purivac system is fully automatic. Purification, dehydration and degasification cycles are thermostatically controlled.

For further data on above items use reply cards on page 194a, identifying your request with letter *P* and number

Profitable way to purchase piping
. . . Get <u>everything</u> from CRANE

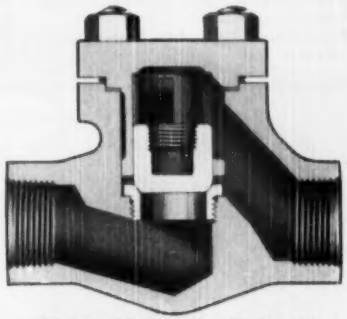
SMALL STEEL LIFT CHECKS WITH BETTER FLOW

Looking for small steel lift checks that don't chatter, and have extremely low pressure drop? Then specify these Crane 600-Pound Forged Steel Lift Checks. They have a patented cap-sleeve construction that provides high disc lift, even at low velocities, thereby eliminating destructive pounding and chattering. Special design of body contours and port openings give unusually low pressure drop.

Seats and discs are of wear-resisting Crane Exelloy. Rugged, forged steel bodies will withstand severe, high pressure services.

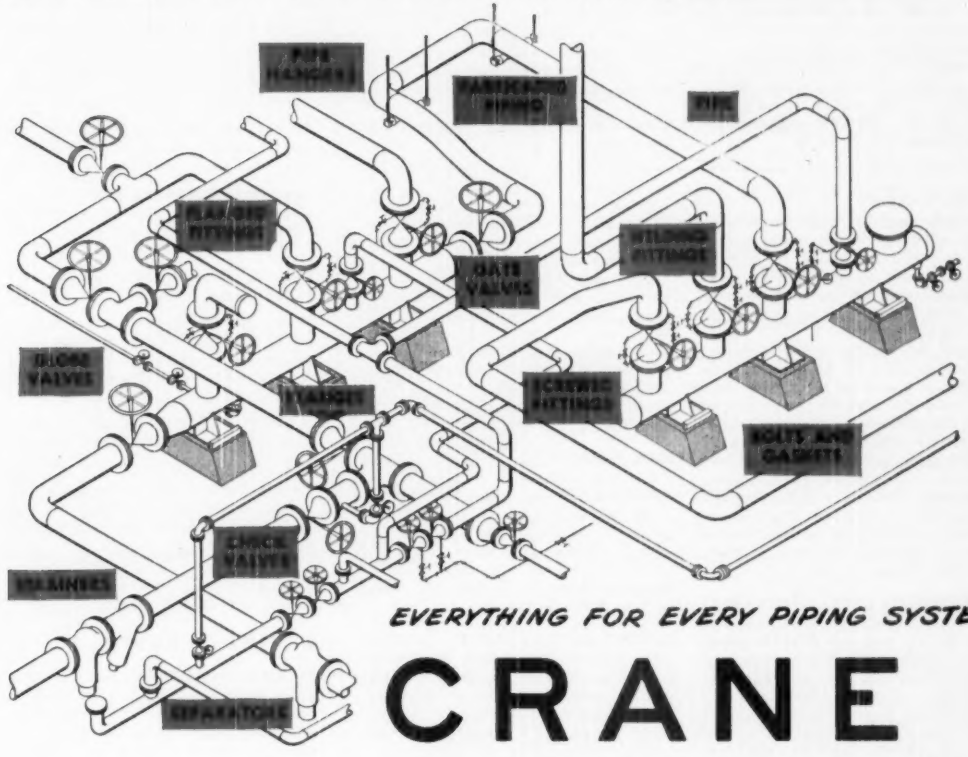
You can get these checks with union caps, screwed or socket welding ends, sizes ¼ through ¾ inches. Or with bolted cap, screwed, socket welding, or flanged ends, in sizes ½ through 2 inches. See your No. 49 Crane Catalog, pages 248-249.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



600-Pound Forged Steel Horizontal Check with Bolted Cap. For steam, water, air, and gas up to 850° F.; for oil or oil vapor up to 1000° F. Sizes: ½ to 2-in. Screwed, flanged, or welding ends.

THIS HIGH PRESSURE STEAM SYSTEM CAN BE 100% CRANE-EQUIPPED . . . THROUGH ONE PURCHASE ORDER



EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

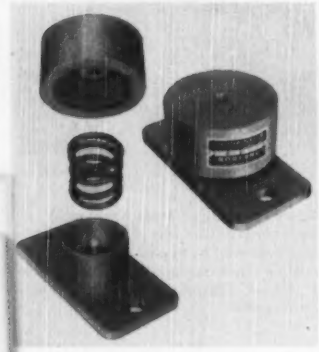
VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

EQUIPMENT NEWS *CONTINUED*

Purification operations may be carried out in the field or at central station while transformer is in service.
Honan-Crane Corp, 616 Wabash Ave, Lebanon, Ind.

HEAT EXCHANGER P616

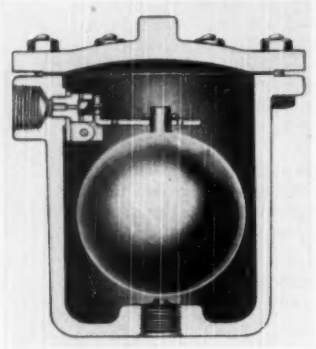
All copper, removable tube bundle, standardized heat exchanger, Type BCP, available in single- and 2-pass designs, in a range of sizes, features this new unit.
Ross Heater & Mfg Co, Inc, 1407-1411 West Ave, Buffalo 13, N. Y.



VIBRATION ISOLATOR P631

Heavy-duty vibration isolator incorporates steel springs to avoid deterioration common to rubber, and to prolong life. *Vibro* Type-F isolator furnished with several standard spring capacities for loads from 10 to 500 lb per isolator.

Housings are malleable castings, sealed by a cylindrical cork ring to snub horizontal thrust, prevent metal-to-metal contact.
Korfund Co, 48-48-D 32nd Place, Long Island City 1, N. Y.



VENT AND DRAIN VALVE P611

Simplified ball-seating instead of a disk improves automatic vent and drain-valve seating to give better operation and longer life. Body and cap of valve are cast iron; the float is copper. Ball seat is *Exelloy*, ball is hardened stainless steel. Complete range of sizes takes care of all air requirements up to 150 psi, and water up to 125 psi.
Crane Co, 836 S. Michigan Ave, Chicago, Ill.

DIESEL WATER P622

Low-cost, rapid-and-accurate, on-the-spot testing of diesel cooling water can be performed with *Chromokit*. In a sturdy metal case there are four sample bottles, a packet of test cards to conduct 80 tests, color standard guide and treatment-adjustment chart.

Sample of cooling water containing treatment, is taken in the dropper bottle. One drop is placed on a test card. After two minutes the color reaction is matched against the standard color guide to indicate chromate strength. Five variations in the standard guide indicates the swing from satisfactory concentration to inadequate. If inadequate, the spot is checked against the Treatment Adjustment Chart to find out amount of additional treatment needed.
Dearborn Chemical Co, 310 S. Michigan Ave, Chicago 4, Ill.

MAGNETIC PULLEYS P647

Improved models of permanent magnetic pulleys provide increased magnetic power, lighter weight and greater structural strength. These magnetic separating devices remove tramp iron from coal and materials being processed in the chemical, food, metal working, textile, milling, ceramic, tobacco and many other industries. They are made in sizes for 12, 15, 18, 20, 24 and 30 in. belts. Belts may be of rubber, leather, canvas, stainless-steel sheet or any other nonmagnetic material.

Dead metal has been reduced, together with total weight, but the weight of alnico magnet metal has been increased. The larger magnets give increased pull and holding power, in some models as much as 50% more than before. Structural strength has also been increased.
Eriez Manufacturing Co, 7 E. 12 St, Erie, Pa.

PIPE COMPOUND P618

Pipe-joint compound, it is said, (1) clings to metal when brushed on (2) has no oil separation so it can be used "right out of the can" (3) does not harden in the can (4) does not freeze-up the joints, yet gives leakproof connection.
Hercules Chemical Co, Inc, 332 Canal St, New York, N. Y.

BOTTOM-DUMP HAULER P646

For bottom-dump hauling; the *Tournahopper* has a heaped capacity of 16 tons or 15 cubic yards. Its 9-ft-square bowl presents an easy target for shovel or dragline to fill. Bottom-dump doors operate like

(*Continued on page* 150)

Scan These Too...

Platform Hoist of tubular-steel cage construction makes the bosun's chair a one-man platform hoist. It's well suited for stack or tank repair or inspection. Foot pedals operate winch ..... p 178

Flexible Coupling features an improvement in the rubber composition of gland ..... p 180

Control Cable for 600-v operation and operating temperature of 168 F. This polyethylene cable is smaller and lighter than conventional cable ..... p 180

Pressure-Testing Device for boilers, piping systems, compressor cylinders, etc. Develops up to 23,000 psi ..... p 182

Cable Fault-Locator consists of a high-voltage dc impulse transmitter with pickup coil and detector. It's designed for locating faults in lead-covered cable installed in ducts ..... p 184

Time-Delay Relay for use with separate motor starter. Will automatically restart motor after momentary voltage fluctuation or power failure ..... p 184

All-Purpose Belting handles elevating and conveying requirements for practically all types of materials from food to gravel ..... p 184

Pump-Protecting Unit prevents pump damage from running without discharge water. This unit automatically stops pump and keeps it from starting till manually reset ..... p 186

Phototube Light Source designed to simplify lamp replacement. Prefocused lamps are used throughout ..... p 188

Level Indicator operates from a 3- to 15-psi pneumatic transmitter or direct from valve-loading pressure to give accurate readings of liquid level ..... p 188

Hand Hoists designed for operation in close quarters ..... p 190

Water Treatment in powder form that's completely soluble. Suitable for sludge conditioning and corrosion protection for diesel or steam-generator service ..... p 192

Cable Reel that's portable. It permits winding and unwinding cable without interrupting service ..... p 192

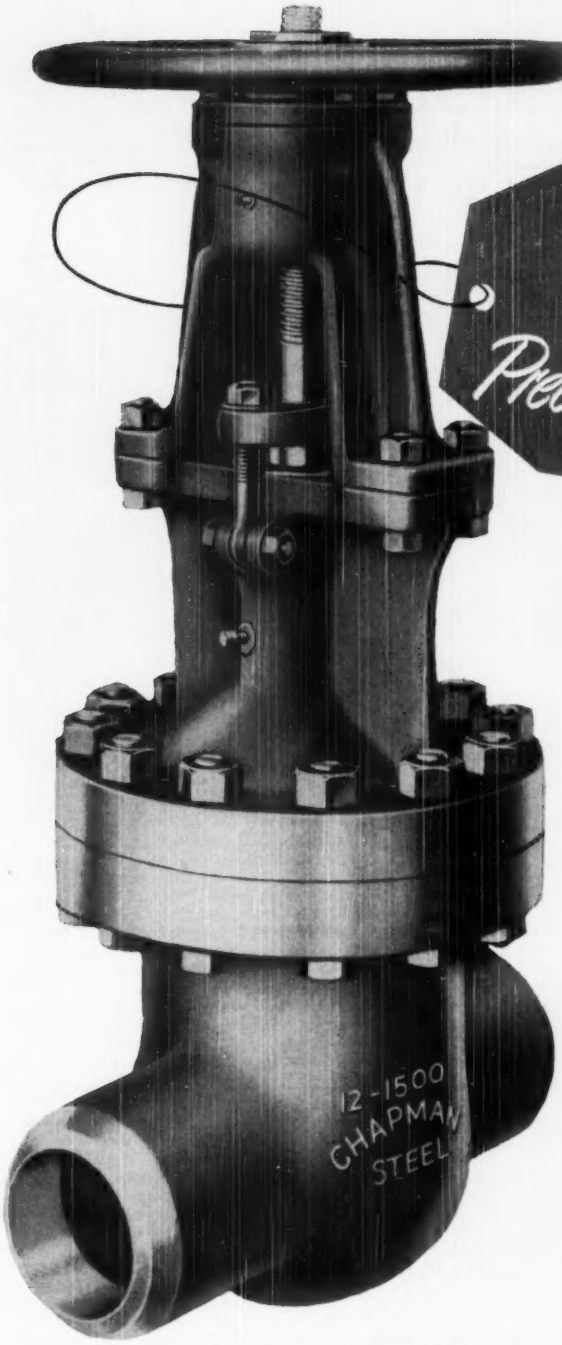
Tilting Motor Base for fractional-hp motors. Handle allows adjusting base to the desired position ..... p 194

Fluorescent Fixture for continuous lighting applications in industrial plants. One-man maintenance ..... p 194

And Next Month...

Hook-On Wattmeter for real and reactive power measurements in single and polyphase circuits. This split-core instrument allows taking power measurements without interrupting service.

For further data on above items use reply cards on page 194a, identifying your request with letter P and number



Flanged bonnet, welding end, high pressure, gate valve.

WHEN YOU WANT

BOTH Precision and Economy

Specify CHAPMAN STEEL VALVES

Want valves with precision ratings that equal or exceed standard specifications? Then specify Chapman Valves. You'll find them the equal of custom-made valves *every time.* Yet they are economical — with the economy that comes from production line manufacture.

You'll find it will pay to specify Chapman valves for every power plant need . . . for longer service, for better service, for lower maintenance.

Available in three types of body and bonnet connections — welded, pressure sealed or flanged. Also in gate, globe, angle, or check types. Welding end valves available in globe as well as in tilting disc styles.

The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASS.

EQUIPMENT NEWS *CONTINUED*

a clamshell, swinging upward alongside the outside of the bowl as they open. Electric operation of the self-cleaning doors permits controlled ejection by opening the doors to any desired width. Where controlled ejection is not needed the doors can open full width, for fast ejection.

The 90-deg, left- and right-turning angle allows the rig to turn on 14-ft radius. This, plus multiple-disk air brakes on all four wheels and electric-power steer, makes the unit safe and easily handled. Speeds range from 3.37 in first gear to 34.61 mph in fifth.

R G LeTourneau Inc, 2303 N. Adams, Peoria, Ill.

ANTI-SIPHON VALVE P619

New angle-type, anti-siphon valve, Type A, is said to be the only one available in 1¼, 1½ and 2 in. sizes, for 5- or 10-ft head pressures, that Underwriters' Laboratories, Inc has approved for No. 6 oil.

Preferred Utilities Mfg Co, 1860 Broadway, New York, N.Y.

MANHOLE STEPS P623

Forged, high-strength aluminum-alloy manhole steps and ladder rungs come in three sizes adaptable to concrete, brick or concrete-block wall. Alloy 61S-T6 gives high corrosion resistance and maximum strength.

Aluminum Co of America, 801 Gulf Bldg, Pittsburgh 19, Pa.

WATER CLEANER P625

Aqua-Clear crystals, placed in a feeder, are dissolved in a water stream and settle out on pipe surfaces to leave a thin film that stops rust, cleans up discharge water.

Sudbury Laboratory, South Sudbury, Mass.

WELDED PIPE P626

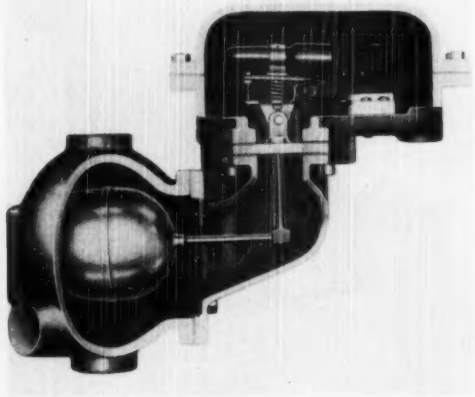
Continuously welded pipe of nickel-copper, low-alloy steel, *Yoloy* is easy to weld, bends and fabricates easily, has high tensile strength, is resistant to abrasion, has high resistance to corrosion and shock.

Youngstown Sheet and Tube Co, Parker and Wallis Aves, Youngstown 1, Ohio.

PORTABLE TOOL CRIB P660

Roll-Cab provides a "shop-on-wheels" that is rolled right to the job. All necessary tools, equipment and other material are carried in the cab, eliminating the time wasted on repeat trips to the tool crib. Top measures 45x24 in. A reinforced solid-steel top plate about 3/16 in. thick is used with a cemented masonite covering.

Snap-on Tools Corp, Kenosha, Wis.



ELECTRIC FLOAT-SWITCH P652

Explosionproof float-operated electric switch for water tanks and other liquid-storage systems. Model No. 65 can be used to make or break electrical circuits at either high or low levels. Float chamber is heavy cast iron, float is copper, float rod is brass.

Maximum body pressure is 40 lb. Device has underwriters' approval for use under Class I, Group C and D atmospheres.

McDonnell & Miller, Inc, Wrigley Bldg, Chicago 11, Ill.

EXPANSION JOINTS P624

Compact, corrugated, packless, in-line expansion joints of copper, stainless steel or other alloys come in two types: (1) controlled flexing joints with control rings for high pressures (2) free-flexing without control rings for lower pressures. These joints are available in complete size range from 3 to 24 in. I.D.

Chicago Metal Hose Corp, 1306 South Third Ave, Maywood, Ill.

MASONRY DRILL P609

Two spiral low-angle flutes are turned in the *Cyclo-Twist* steel-drill body. Diameter of body is the same as that of the hole to be drilled so maximum steel support is given to the carbide tip.

Because this construction gives a positive dust lift, the hole does not need to be cleaned, the drill stalled or slowed down. Drills come in sizes from 3/16 to 1 in.

New England Carbide Tool Co, Inc, 60 Brookline St, Cambridge 39, Mass.

HUMIDITY CONTROL P656

An instrument that records and automatically controls humidity utilizing the psychrometric wet- and dry-bulb principle. Controller automatically regulates the wet-bulb (relative-humidity) depression for which it is set, regardless of any fluctuations in the dry-bulb temperature.

Two pens operate on a circular 10-in. chart, simultaneously recording dry-bulb temperature and wet-bulb depression. Flow of the humidifying agent, moisture, steam or oil fog is regulated by a valve that's operated by the control instrument.

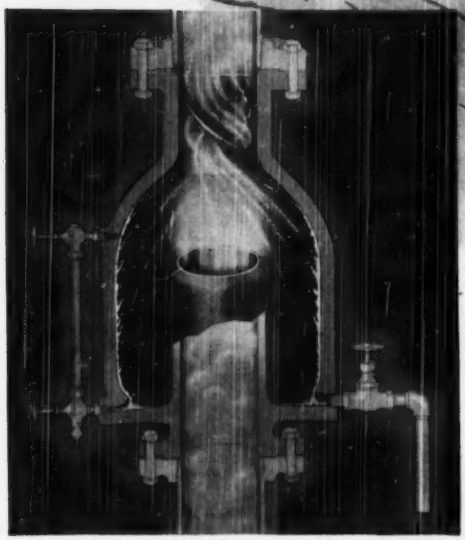
Weston Electrical Instrument Corp, 614 Frelinghuysen Ave, Newark 5, N. J.

FLUID-PRESSURE BOOSTER P645

Designed to supply fluid power for driving the working cylinders in clamping, punching, shearing, riveting, welding and other applications, these fluid-pressure

For further data on above items use reply cards on page 194a, identifying your request with letter P and number

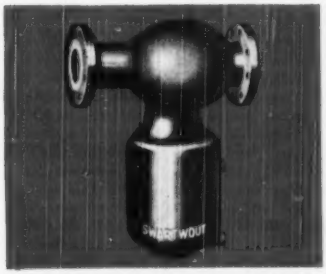
Swartwout helico-centrifugal separators assure 99% dry steam or better—with negligible pressure drop!



1 THE WHIRL DOES THE TRICK! Helix, located near separator inlet, imparts positive whirling motion . . . removes entrained liquids, solids, oil or grease from live or exhaust steam, from air or chemical vapors—*virtually without pressure loss.* Swartwout separators have no baffles, plates, grids or other parts to cause flow reversals, velocity heads or vibration. Vertical separators, above, for up flow or down flow, supplied in 50 to 600 lb. standards.

Swartwout

POWER PLANT EQUIPMENT



2 HORIZONTAL SEPARATORS, built on helico-centrifugal principle, handle any sort of separation with a maximum pressure loss of only a few inches of water under high working pressures or under vacuum. Cast iron for 50, 125, 250 lb. standards; cast steel for 150, 300, 400, 600 lb. standards.

3 EXHAUST HEADS, employing same helico-centrifugal principle as Swartwout separators, remove moisture and oil from exhaust steam . . . prevent rotting of roof and walls in warm weather and ice formation in winter. For exhaust pipes from 1 to 30 inches in diameter. See Bulletin S-16-C.

4 SWARTWOUT AIRFUGE air separator removes impurities by centrifugal force. Simple, float-operated trap releases accumulated liquids automatically while maintaining level sufficient to effect seal. Requires no maintenance except occasional blowdown. Write for special Airfuge Bulletin S-13. A-2709

SEND FOR BULLETIN S-14-C • THE SWARTWOUT COMPANY • 18511 EUCLID AVENUE • CLEVELAND 12, OHIO

EQUIPMENT NEWS *CONTINUED*

boosters develop hydraulic working pressures, up to 10,000 psi from ordinary plant air or hydraulic supply. Booster cylinder can do work that would require an air cylinder ten times the size, and results in large space saving. Booster need not be mounted on the equipment and several working cylinders can be operated from one booster.

Because they hold pressure indefinitely without motion or heat generation, they can be used often in place of pumps. To operate the booster, input pressure can be air or hydraulic, but output pressure is always hydraulic. Operating speed range is from 30 to 450 strokes per minute.

Miller Motor Co, 427 N. Kedzie Ave, Chicago 18, Ill.

VENTILATOR CONTROLS P610

Positive control of all interlocking unit ventilators improves performance and dependability in schoolrooms, auditoriums and gymnasiums. Cam-operated limit and auxiliary switches are part of the controls. Noiseless gears work the operators under the drive of high-output electric motors.

Barber Colman Co, 115 Loomis St, Rockford, Ill.

FIRE EXTINGUISHER P612

New cartridge-operated water-type fire extinguisher with stainless-steel shell eliminates annual cost and nuisance of recharging required by soda-acid extinguisher. Carbon-dioxide pressure cartridge need be replaced and water replenished only if extinguisher is discharged.

Pyrene Mfg Co, 560 Belmont Ave, Newark 8, N. J.

SIEVE SHAKER P608

Small, vibrating-test sieve shaker for laboratory screen-analysis work employs six 8-in.-dia sieves. The nested sieves go into the shaker and lock in place. The shaker itself is set on three adjustable feet to permit perfect leveling. An electromagnet drive, energized by rectified, half-wave ac, gives the shaker 3600 vibrations per minute from 60 cycles.

Syntron Co, Homer City, Pa.

BRAZING, SOLDERING RINGS P607

Stress-relieved, *No-Tangle*, notched coil rings improve brazing and soldering applications. Stress-relieving prevents rings from distorting or creeping when heat is applied.

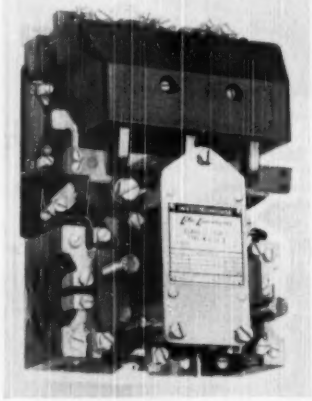
These rings can be partially stress-relieved to expand when detached from the coils so they may be compressed in grooves in inside diameters. Preforms are wound from *Easy-Flo*, *Sil-Fos*, and *Phos-Copper*. They fuse with metals at low temperatures to form strong, gastight joints.

Lucas-Milhaupt Engineering Co, 5057 S. Lake Drive, Cudahy, Wis.

INSULATION TESTER P662

Megohmmeter is available with ohm scale and selector switch in ranges 0 to 10 megohms (100 v), 0 to 20 megohms (250 v), and 0 to 50 megohms (500 v). Most important uses include the diagnosis of trouble in all types of electrical equipment, including motors, generators, rotary converters, transformers, exciters, power cables, etc.

James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa.



MOTOR STARTER P666

Ac, magnetic, nonreversing *De-ion Life-Linestarter* is designed for either across-the-line starting of squirrel-cage induction motors, or as a primary switch for wound-rotor induction motors. Starter has only one moving part, a lever balanced on a knife-edge bearing or center fulcrum.

Available in NEMA sizes 0 through 4, the *Life-Linestarter* can be applied to all integral horsepower motors up to 100 hp. It is supplied in standard ac-voltage ratings from 110 to 600 at frequencies of 60, 50 and 25 cycles, for 3-phase, 2-phase, 4-wire and single-phase operation.

Westinghouse Electric Corp, 306 Fourth Ave, Pittsburgh 30, Pa.

BOILER-WATER TEST SET P602

Test set for small plants, laundries, etc. enables control of phosphate and alkali dosages; regulation of blowdown.

A small wooden box, 10x5½x5 in., with hinged cover, contains standard acid and silver nitrate in drop bottles, three reagents for phosphate tests, two indicators in dropping bottles, calibrated tubes for phosphate, alkali determination, two phosphate standards, funnel, beaker, porcelain dish, stirring rod and set of instructions.

Barclay Chemical Co, Inc, 20 Albany St, Cambridge 39, Mass.

INDUSTRIAL LUBRICANT P603

All-purpose, nonmelting grease, *Plastilube*, has high adhesive qualities, excellent pumpability at low temperatures. It does not break down during work.

Warren Refining & Chemical Co, 750 Prospect Ave, Cleveland 15, Ohio.

RUBBER-COATED HOOD P604

Special rubber-coated hood is impervious to moisture, most acids, caustics, oils, solvents. It protects against extreme temperature and light metal splashes.

General Scientific Equipment Co, 2700 W Huntington St, Philadelphia 32, Pa.

PUMP PROTECTOR P632

In mechanical failure or lowering of water table, *Protectrol* automatically stops your pump, keeps it from starting until manually reset. Emergency conditions cause unit to sound an alarm and light a warning light.

Unit comes with an alarm silencer and automatic reset. Pushing manual reset button restores all circuits to regular operation. Time interval can be varied through a thermal time-delay unit.

Automatic Control Co, 1005 University Ave, St. Paul 4, Minn.

PORCELAIN BEARINGS P606

Selflubricating, porcelain-enameled, cast-iron or steel bearings serve where ordinary bearings cannot. They can be applied for use in high temperatures, where metal contacts may cause electrolysis, or where corrosive fluids are employed. A synthetic-rubber journal that fits over the shaft to absorb shaft whip and vibrations runs against the bearing surface. This contact is the only limitation on the corrosive-fluid service.

Porcelain Enamel Institute, Industrial News Service, 521 Oliver Bldg, Pittsburgh 22, Pa.

MOTOR SPEED-CONTROL P664

Thyratron-type motor speed-control system operates dc motors from an ac line. Shunt-wound 115-v motors from one-thousandth to one-tenth hp may be controlled over a speed range of better than 50 to 1,

(*Continued on page* 178)

For further data on above items use reply cards on page 194a, identifying your request with letter P and number

DOWELL

SPECIALISTS IN SCALE AND SLUDGE REMOVAL WITH CHEMICALS

800 FEET OF BURIED WATER LINE CLEANED IN 8 HOURS BY DOWELL CHEMICAL SCALE REMOVAL SERVICE

Dowell Service may save you important dollars by cutting out-of-service time in maintenance cleaning to a minimum. Special chemical solvents, introduced into water lines through regular valve openings, are designed to dissolve and disentegrate scale and sludge deposits *without dismantling* the line! For example, Dowell engineers were recently called in to clean 800 feet of 4" buried water line heavily scaled with three quarters to one inch of calcium carbonate. *Within eight hours, the water line was back in use with its volume increased from 45 g.p.m. at 32 lbs. to 125 g.p.m. at 24 lbs.!*

Underground or above, indoors or out, if you have a water or product line cleaning problem, call Dowell. Leading utilities, railroads and other industries have found the Dowell Service method practical, reliable and economical. Thoroughly trained Dowell engineers do the entire job, bringing all necessary chemicals and equipment to your plant in special tank trucks.

Call your nearest Dowell office today and find out about rapid, convenient, economical Dowell Chemical Scale Removal Service for heat exchange equipment, boilers, condensers, water-lines—and for increasing water well output. Free cost estimates are gladly given.

DOWELL INCORPORATED · TULSA 3, OKLAHOMA

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

CALL

New York 20	Buffalo 2	Kansas City 8	Mt. Pleasant, Mich.
Boston 16	Cleveland 13	Wichita 2	Hamilton, Ohio
Philadelphia 2	Pittsburgh 19	Oklahoma City 2	Charleston 27, W. Va.
Baltimore 18	Detroit 2	Houston 2	Salem, Illinois
Wilmington 99	Chicago 2	New Orleans 12	Borger, Texas
Richmond 19	St. Louis 8	Ft. Worth 2	Midland, Texas
Jacksonville	Indianapolis	Shreveport 23	Wichita Falls, Texas
Atlanta	Louisville	Anniston, Alabama	Lafayette, La.

Long Beach, Oakland, Casper: Dowell Associate-International Cementers, Inc.

DOWELL

It Never Should Have Happened

This one started with an argument settled in a childish fashion. It was climaxed by a stupid mistake that's going to cost someone time and money.

A new tenant was taking over one whole floor of this Midwestern office building. They had many business machines requiring alternating current, but the building plant generated dc only. Also, they wanted fluorescent lighting. So the building manager, representing the owners, decided to bring in ac from outside for that one floor.

During the planning stages, the contractor and the building's chief engineer disagreed about where the main feeders should run. The manager settled the whole argument by suggesting that the chief engineer had enough to do running the power plant. He had no choice but to stay out of it.

Work on the electrical wiring was just beginning when the new tenant decided to put in air conditioning. A second contractor was brought in to do this job. Only he wanted to run his own wiring from the new ac service to his motor-driven compressors.

This was OK, except that the chief engineer was now back down in the power plant with orders to stay put, and the only man overseeing both contractors was the building manager, a real-estate man, not an engineer.

While the ductwork was going in, the electrical contractor finished his work. The building manager inspected the job, accepted it, and made final payment. The electricians moved out.

Not long after, the air-conditioning contractor was ready to run his lines from the main ac feeders to the compressors. They anticipated no trouble. The electrical specs showed plenty of feeder capacity for the lights, business machines and air conditioning.

The plans said the main feeders were 4/0-gage wire with a capacity of about 300 amperes. But the wire that went in turned out to be 2/0-gage with a capacity of only about 200 amperes. That was not enough. It meant running new feeders, or cutting the load to a bare minimum, or putting the lights back on dc. As far as I know, it's not straightened out yet.

But the building manager has finally realized his original mistake and tossed the whole problem back in the lap of his engineer, where it should have been all along.

How or why the smaller wire got installed, I don't know. But you can bet your life it wouldn't have sneaked in if our engineer friend had been watching the job.

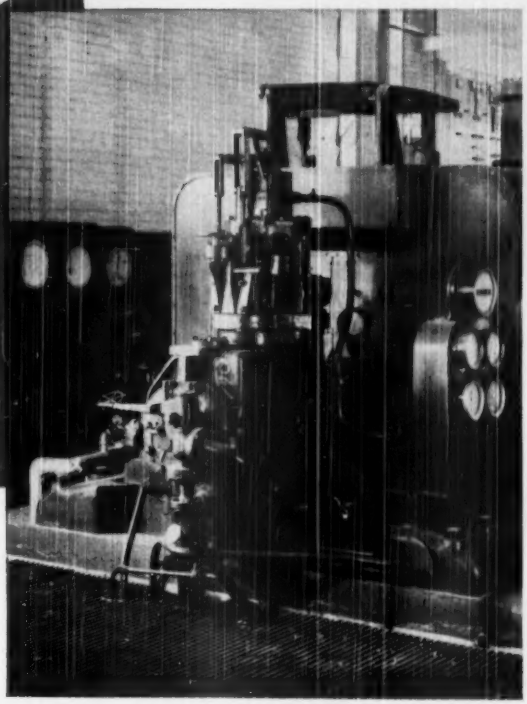
So I think this whole episode proves one important point:

The power engineer is a mighty valuable man. Any boss that bypasses his engineer and tries playing engineer himself should think twice of the consequences.

George Edwards

Engineer

Here's your proof of CONSTANT TURBINE SPEED



When Texaco Regal Oils (R&O) are on the job keeping turbine systems clean

The tachometer tells the story: governors respond instantly and accurately to every load change and keep turbine speed constant . . . when you use *Texaco Regal Oils (R & O)*, the lubricants that keep circulating systems clean.

Texaco Regal Oils (R&O) are specially fortified to resist oxidation, emulsification and sludging. They contain an effective rust-inhibitor, and are processed to prevent foaming. Because *Texaco Regal Oils (R&O)* keep oil lines clean and clear, bearings get full protection . . . governors function properly.

Extra-long service life is another advantage of *Texaco Regal Oils (R&O)* . . . and these fine oils meet the exacting requirements of all leading turbine builders. Let a Texaco Lubrication Engineer help you select the *Texaco Regal Oils (R&O)* best suited to give best results under your particular operating conditions.

Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

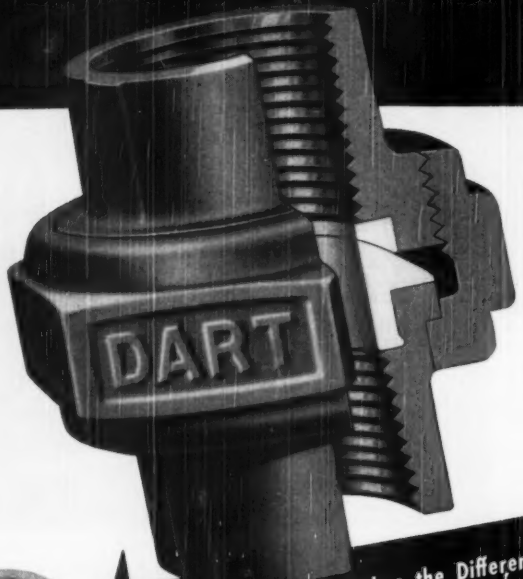
TEXACO Regal Oils (R&O)

FOR ALL TURBINES

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. See newspaper for time and station.

NO NEED TO JAM A DART

to get a Drop-tight Joint



This True Ball Joint Makes the Difference

Drop-tight Without Jamming! — that's the reason Darts are your best buy. There's no need to use excessive wrenching to get a tight connection. The two bronze seats have the wide, true-bearing surfaces that come only from precision grinding. Thus you can tighten a Dart easily without jamming the seats. Uncouple them easily, too, for reuse again and again.

And to give extra resistance to stress and stretching, both body and nut are made of high-quality, air-refined malleable iron . . . practically indestructible.

No wonder Darts always cost less in the long run . . . always give longer, better service.

E. M. DART MFG. CO.
Providence 5, Rhode Island

DART
UNIONS

ELECTRONICS

(*Continued from page* 123)

from its minus side through resistor R_9, the grid and cathode to + on C_1. Capacitor C_3 does the same from its minus terminal direct to the grid, cathode and to its + side.

Right-hand side of tube E conducts on the same polarity as does phototube P. This circuit is from − line, tube V to F and to the cathode, anode, resistors R_7 and R_8 to the + line. Because of the comparatively low minus bias on grid G_1, voltage drop across the right-hand cathode and anode of tube E is quite low and that across resistors R_7 and R_8 correspondingly high. The latter puts a high minus bias on thyratron E_1 to prevent it conducting. Grid circuit is from the connection on R_8 through resistance R_9 to the grid and cathode, to B, and to the + line.

Capacitors Maintain Grid Bias. Capacitors C_2 and C_4 are charged to the polarity shown. Then when line polarity reverses, capacitor C_2 discharges through resistors R_7 and R_8. It also tends to discharge from the tap on R_8 through R_9, the grid and cathode to its + side, to maintain a minus bias on tube E_1 grid. Capacitor C_4 discharges from its minus side through the right-hand end of R_8 back to its plus side. It also tends to discharge from the grid to the cathode to assist in maintaining a minus bias on the grid to prevent tube E_1 from firing. When line polarity reverses and the voltage starts to build up, the cycle of operations repeats.

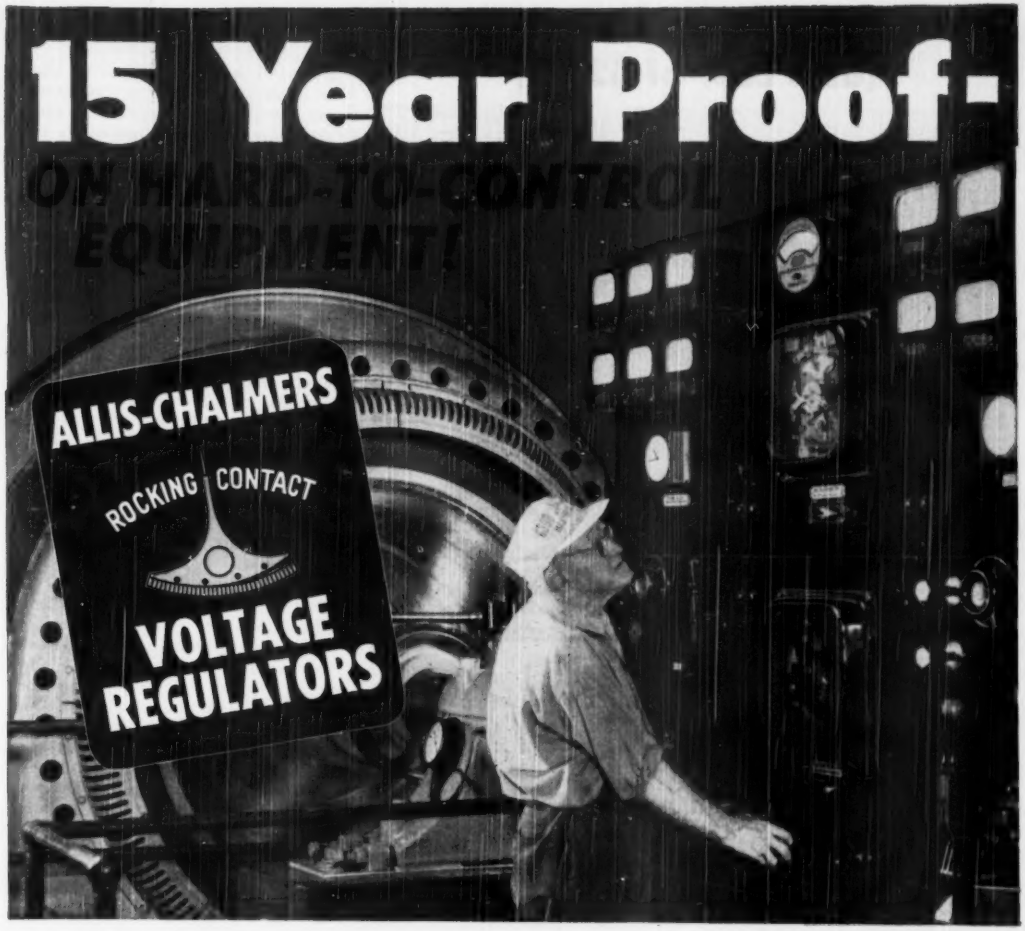
Stack-Haze Dense. If the stack-haze becomes too dense, amount of light reaching the phototube is reduced and, current through it and resistor R_6. This reduces minus bias on grid G to where there is a large increase in current flow through the left-hand side of the tube. Current flow increases through the smoke indicator and this meter deflects to the dark side to show smoke density.

Because of increased flow through R_5, voltage rises at A to increase minus bias on grid G_1 and reduce current flow through the right-hand side of the tube, R_7 and R_8, to where thyratron E_1 fires. On reverse polarity, current flows from − line, cathode and anode of E_1, red lamp R and back to + line. Current also flows through the relay's coil and closes contact D to sound the horn or other alarm. This calls the boiler operator's attention to the objectionable smoke condition. When the stack clears, the smoke-density indicator returns to normal and minus bias increases to stop thyratron E_1 conducting.

In the next article we will continue our study of smoke-density indicators, and examine one unit that uses photovoltaic cells as the light-sensitive elements.

15 Year Proof-

ON HARD-TO-CONTROL EQUIPMENT!



REGULATING VOLTAGE for the Good Samaritan Hospital of Cincinnati since 1934 without maintenance or repair of any sort except for one bearing adjustment . . . that's the record of these Allis-Chalmers Rocking Contact Voltage Regulators. "Our machinery is slow speed—difficult to control—yet our regulation is good!" says Mr. W. A. Garrett, Chief Engineer.

This is the kind of *proven* dependability and low maintenance you can get with Rocking Contact Regulators. They have no vibrating contacts and no gliding friction . . . no complex adjustments to make. This simplicity means years of trouble-free service for you.

They are precision built for *Instant Response* and *Accuracy*. Contact sectors are supported in jeweled bearings . . . rock on carefully machined commutator segments heavily plated with silver for reliable, long-life accuracy.

Rocking Contact Voltage Regulators are available for both a-c and d-c generators of any size and speed, for either parallel operation or unit control. Call your nearby A-C office or write direct. A-2887

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.

OTHER ALLIS-CHALMERS SPECIAL CONTROL

SYNCHRO-OPERATOR — Automatically synchronizes alternating current generators, tie lines, synchronous condensers, etc.

D.C. POSITIONER — Operates from power plant d-c bus, used for remote indication, control, order telegraph, etc.

REGULEX CONTROL — Used where the features of a rotating type regulator are desired.

Regulex is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment from Generation through Utilization

How to meet a payroll (at a cost of $3.19)

Twenty-four hours before factory payday, another check-writing machine was needed *fast*. At 10 A.M. plant manager ordered one from supplier 400 miles away. He specified Air Express, the service regularly used to keep production rolling. 26-lb. carton delivered same day at 2 P.M.—in time! Shipping cost only **$3.19!**

$3.19 was total cost—and *included* door-to-door service! Air Express is the most convenient way for you to ship or receive—in addition to being the world's fastest transportation method.

You get round-the-clock service with Air Express. Shipments go on all flights of the Scheduled Airlines. Air Express is service you can *count on* to keep your business rolling in high gear.

Air Express gives you all these advantages

World's fastest transportation method.
Special door-to-door service at no extra cost.
One-carrier responsibility all the way.
1150 cities served direct by air; air-rail to 18,000 off-airline offices.
Experienced Air Express has handled over 25 million shipments.

Because of these advantages, regular use of Air Express pays. It's your best air shipping buy. For fastest shipping action, phone Air Express Division, Railway Express Agency. (Many low commodity rates in effect. Investigate.)

AIR EXPRESS
GETS THERE FIRST

Rates include pick-up and delivery door to door in all principal towns and cities

A service of
Railway Express Agency and the
SCHEDULED AIRLINES of the U.S.

Technical Briefs

(*Continued from page* 138)

excitation systems. Thus, in an effort to obtain more reliable and continuous excitation service, electronic ignitron rectifier exciters were applied to two new 37,500-kva 3600-rpm turbine-generators in the Warren plant of Pennsylvania Electric Co.

Power source of the exciter is a small 6-phase generator connected to the same shaft as the main generator and so is free from system electrical disturbances. A test of the first exciter with a large synchronous machine in the shop demonstrated fundamental soundness in operation. Additional tests were made after installation in the power plant, and after certain changes both exciters have given excellent service. One has been in operation about six months, and the other over a year. There is no other source of excitation for these two generators.

Advantages of this exciter are given as: (1) Parts may be maintained or replaced with rest of units in service. (2) It is a static device. (3) It has inherent qualities of a conventional direct-connected exciter in freedom from system disturbances, high-speed excitation and range of excitation. (4) It is expected to prevent generator outage caused by failure of excitation. (5) It is equivalent to more than one conventional exciter.

The disadvantages are: (1) Cost is high—two to three times that of conventional exciters having dc generators direct-connected or motor-driven. (2) It requires more space and volume than a conventional direct-connected exciter, although space and volume taken by conventional spare exciters must be evaluated. (3) It has many more parts, consisting of control transformers, tubes, control wiring, contacts, etc, than are required by conventional excitation systems. *AIEE Paper No. 50-50.*

LARGE ELECTRONIC DC MOTOR DRIVES IN INDUSTRY, *by M S Morack, General Electric Co.* Application of adjustable-voltage rectifiers for driving dc motors, or groups of motors, and the characteristics required for a range of applications are enumerated. Means for securing these characteristics are described. In recent years industry has slowly returned to dc motors for many applications. It is now apparent that adjustable-speed dc drives are necessary to obtain the high performance standard required by modern industrial operation. One cannot foresee every condition of process that might need an adjustable-speed drive. But the factors group themselves under a few main divisions.

1. *The Part Process.* A machine driven by a constant-speed drive may

BIG DIPPER

ONE BITE—and this world's largest power shovel—at the Hanna Coal Company's Georgetown, Ohio, mine—strips off enough overburden to fill the living-room of an average American home! The bucket holds 45 cubic yards—can be swung two-thirds of a city block to dump its load.

This one machine has all the complicated lubrication problems of a factory...requires a complete lubrication program to maintain peak efficiency. Socony-Vacuum was entrusted with this job...supplies the right grease for those cable sheaves... the right hydraulic oils for those giant jacks...the right lubricants for those swing, crowd, and crawler gears...other lubricants for all machinery inside.

You, too, can get such a program of *Correct Lubrication* —backed by our 84 years' experience. Just call your Socony-Vacuum Representative.

Gets the World's Greatest Lubrication Knowledge and Engineering Service

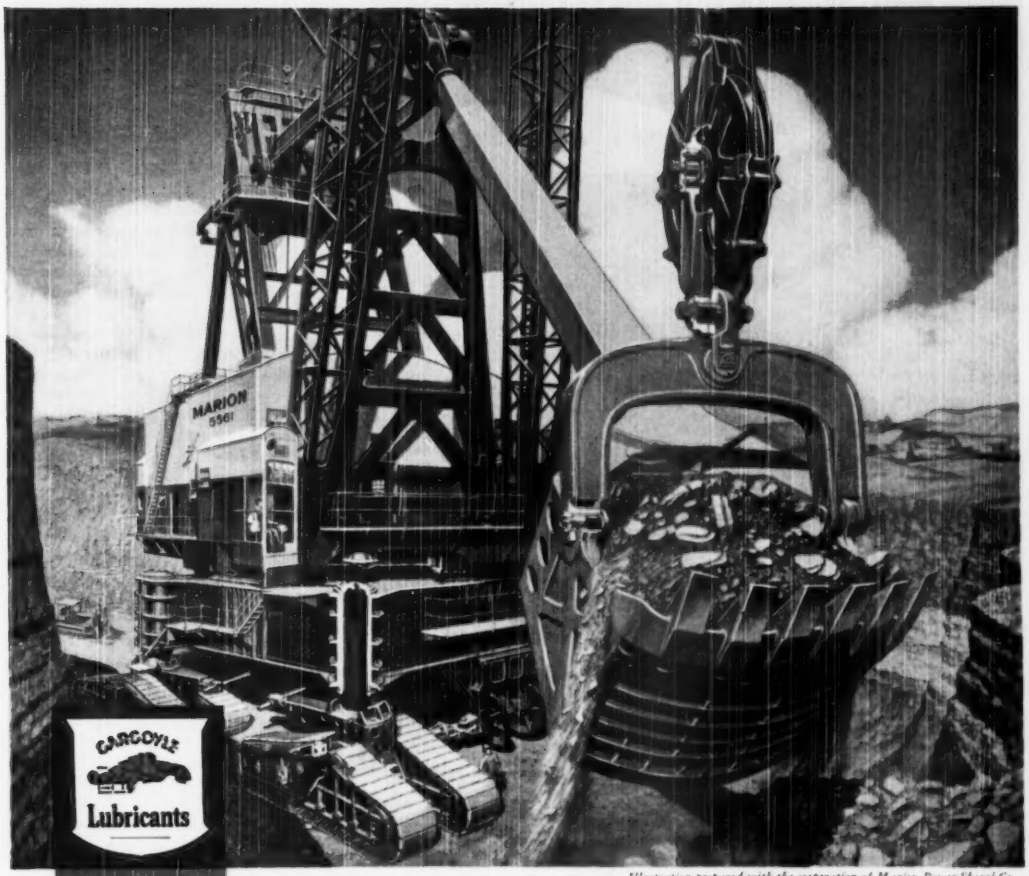


Illustration prepared with the cooperation of Marion Power Shovel Co.

SOCONY-VACUUM

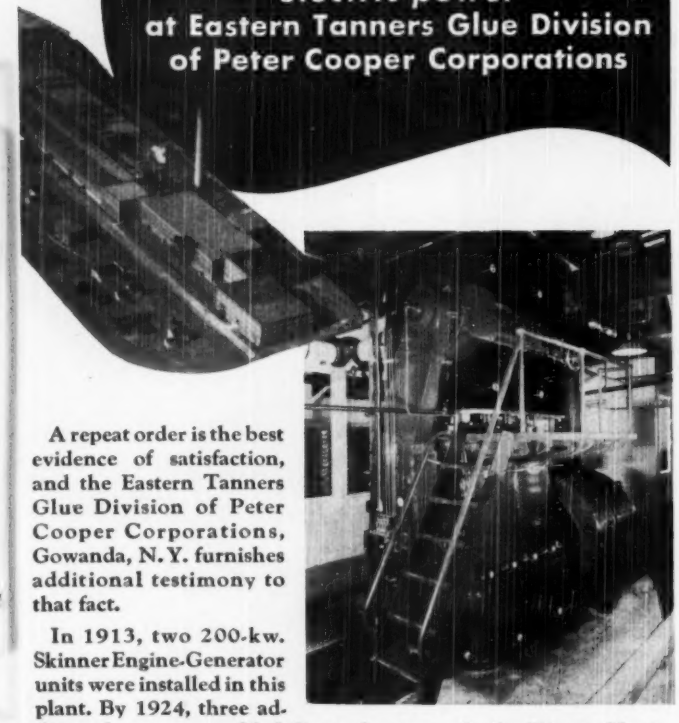
Correct Lubrication

SOCONY-VACUUM OIL CO., INC.
and Affiliates:
MAGNOLIA PETROLEUM COMPANY
GENERAL PETROLEUM CORP.

Since 1913

SKINNER
ENGINE-GENERATOR UNITS

have supplied the electric power at Eastern Tanners Glue Division of Peter Cooper Corporations



A repeat order is the best evidence of satisfaction, and the Eastern Tanners Glue Division of Peter Cooper Corporations, Gowanda, N. Y. furnishes additional testimony to that fact.

In 1913, two 200-kw. Skinner Engine-Generator units were installed in this plant. By 1924, three additional units were added. Recently a two-cylinder Skinner Vertical "Universal Unaflow" Steam Engine, directly connected to a 400-kw. D.C. generator, was installed. All six engines are still in operation and have a total capacity of 1500 kw.

Eastern Tanners Glue, like many others who have enlarged their plant capacity, have found it more economical to install additional Skinner "Universal Unaflow" Steam Engines to meet their increased power requirements.

Our engineers will make accurate estimates to prove you can produce dependable power at a fraction of the cost of purchased power. Write for detailed information of the advantages of Skinner "Universal Unaflow" Engines in your field.

For Over 80 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

be limited to making a small range of products. An adjustable-speed drive may be necessary if the user is to get maximum usefulness during the machine's entire life.

2. *Different Kinds of Material.* Various kinds of material are common in the metal-working industry. With the numerous kinds of alloys in ferrous materials, for example, a machine that does not have an adjustable-speed drive is bound to be inefficient for working some materials.

3. *Changes in Physical Properties.* Physical properties of a given material, that is, hardness, sheer strength and machineability, may change to cause variation in performance.

4. *Process Coordination.* A piece of material, such as, a strip of steel, a web of cloth, or a piece of paper, may pass in continuous flow from one machine to another with each unit doing work on it. Speed of each machine in the continuous line must be adjusted if processing is to be at a uniform rate.

5. *Variation During Processing.* Size change during the processing is the most usual variable that requires change in speed. In a printing press, for example, it is necessary to reduce printing speed while full rolls of paper are pasted to a used roll. Size variations, intentional and otherwise, are bound to occur in a given material and may call for change in speed.

6. *Starting Function.* Starting many types of mills will frequently require jogging or inching in combination with slow running to enable an operator to thread a web through the machine.

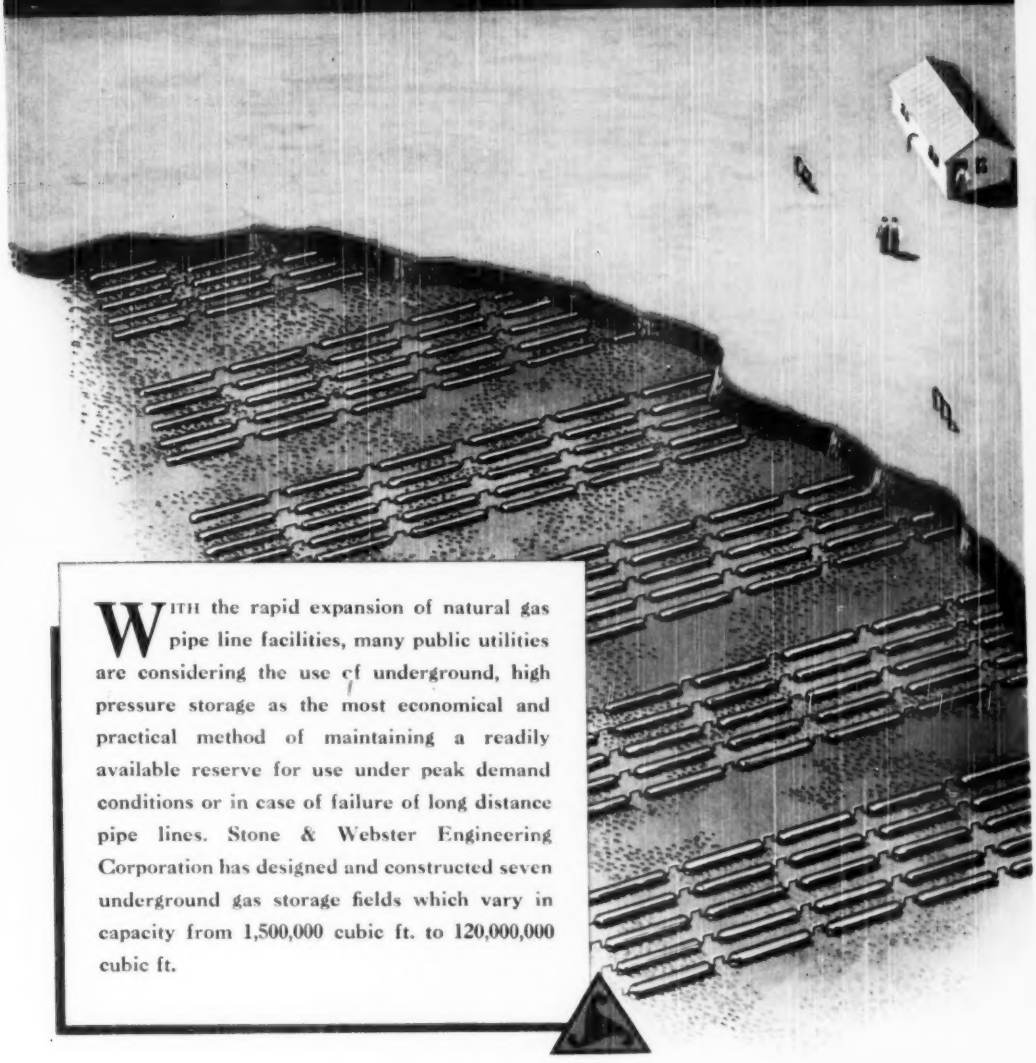
There is an endless list of applications of adjustable speed in combination with control functions where the benefits of adjustable speed reach their maximum and future possibilities.

The author concludes that suitable rectifier devices and power circuits have now been developed that permit a new approach to the problem of adjustable speed and motor drives for industry. The new electronic tools give control flexibility, higher efficiency and maintenance ease unmatched by older adjustable-speed drives. Electronic drives offer the best chance of over-all cost reduction. *AIEE Paper No. 50-31.*

LIQUID COOLING OF AC TURBINE-GENERATORS—PART II, by Carl J Fechheimer, *consulting engineer, Milwaukee, Wis.* Author presented a previous paper before the AIEE in 1947, outlining the cooling media he advocated for large turbine-generators: (1) oil or equivalent synthetic liquid for the stator (2) water for the rotor and (3) hydrogen for the internal surroundings of stator and rotor.

From a thermal standpoint, this combination is superior to any. But in view

From Nature's Gas Wells to Man Made Storage



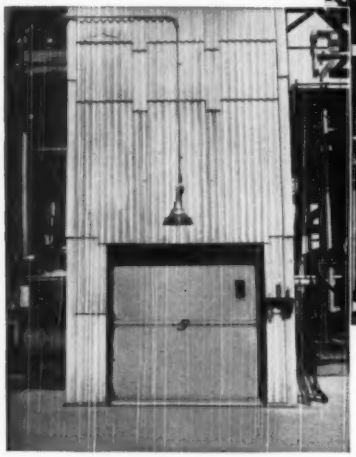
WITH the rapid expansion of natural gas pipe line facilities, many public utilities are considering the use of underground, high pressure storage as the most economical and practical method of maintaining a readily available reserve for use under peak demand conditions or in case of failure of long distance pipe lines. Stone & Webster Engineering Corporation has designed and constructed seven underground gas storage fields which vary in capacity from 1,500,000 cubic ft. to 120,000,000 cubic ft.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

K&M *"Century"* ASBESTOS CORRUGATED WALLS

NOT PERISHABLE



Mid-Continent Petroleum Corporation Refinery, West Tulsa, Oklahoma.

Elevator Tower and Penthouse protected by K&M "Century" Asbestos Corrugated, applied with "TOP-SIDE"* Fasteners.

Industrial and commercial building walls need a rugged constitution. That's exactly why K&M "Century" Asbestos Corrugated walls are bound to be an economy for you. They provide all the structural strength and staying power of the proved K&M Asbestos-Cement combination. They shed extremes of weather and other atmospheric threats, without even needing paint. They defy fire, rust, rot, rodents and termites. You can plainly add it all up to long-term freedom from maintenance.

Initial savings are just as plain, for K&M "Century" Asbestos Corrugated goes up fast, no special work needed. Fitting is easy with ordinary cutting and drilling tools. Even scaffolds and extra labor can be eliminated by using "TOP-SIDE"* fasteners. They're made so that K&M Corrugated can be anchored to steel members of any type, on sides or roofs. You'll have protective enclosure—and cost figures—that keep on looking good.

Write for the name of your nearest K&M Distributor, and full data on K&M "Century" Asbestos Corrugated.

*T.M. H. & B. Enterprise Corp.

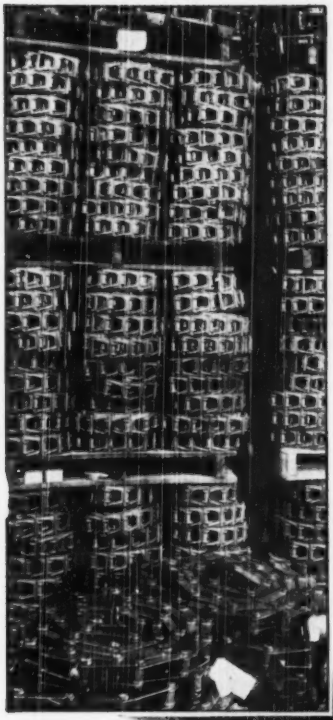
Nature made Asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K&M Best in asbestos

In Canada — ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG and VANCOUVER

CHAINS *from* STOCK



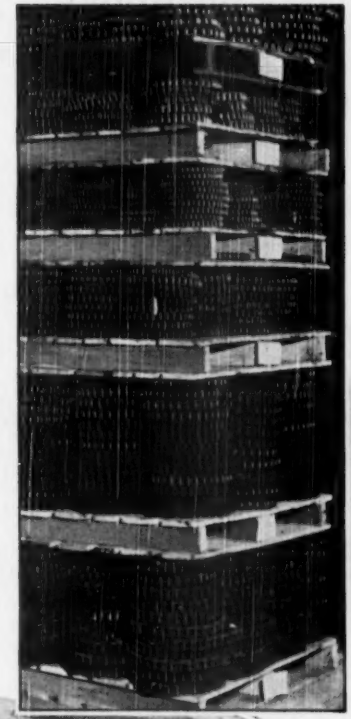
Popular types and sizes available at once from Columbus—from our distributors in all industrial centers

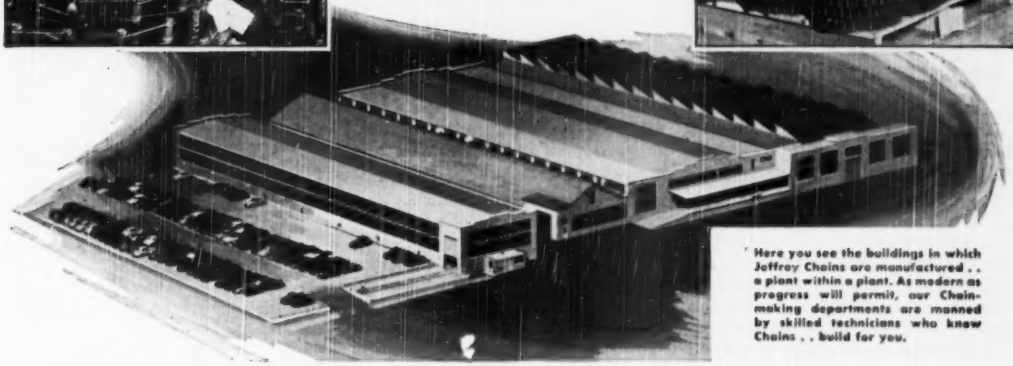
NEED CHAINS? We can ship immediately from our large stock here at home or you can contact any one of our authorized Stock-carrying Distributors, strategically located throughout the United States to better serve your needs.

Our recently-enlarged Chain-making establishment (see photo below) is fully equipped with new high-speed tools . . every modern facility to make chains scientifically better . . faster.

A large assortment of Sprockets, Gears, Pulleys, Babbitted Bearings and other Transmission items are also available for prompt shipment, as well as a line of Spiral Flights, Belt Idlers, etc.

We will be glad to take care of your requirements . . will handle those "Ship At Once" requests promptly. May we hear from you?





Here you see the buildings in which Jeffrey Chains are manufactured . . a plant within a plant. As modern as progress will permit, our Chain-making departments are manned by skilled technicians who know Chains . . build for you.

THE JEFFREY MANUFACTURING COMPANY

Established 1877

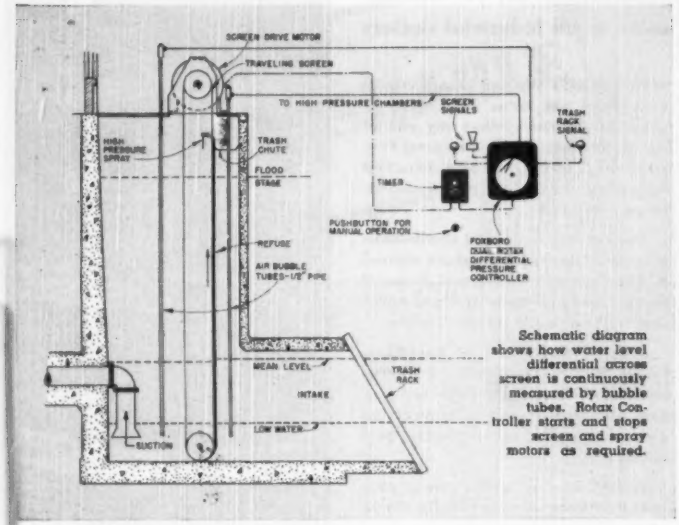
932 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

Baltimore 2, Birmingham 3, Boston 16, Buffalo 2, Chicago 1, Cincinnati 2, Cleveland 13, Denver 2, Detroit 13, Harlan, Houston 2, Huntington 19, Jacksonville 2, Milwaukee 2, New York 7, Philadelphia 3, Pittsburgh 22, St. Louis 1, Salt Lake City 1, Scranton 3

Jeffrey Mfg. Co., Ltd., Head Office & Works: Montreal

Make traveling intake screens positively "Plug-Proof"



Schematic diagram shows how water level differential across screen is continuously measured by bubble tubes. Rotax Controller starts and stops screen and spray motors as required.

...with Foxboro liquid level type screen control

Make sure your intake suction well can't go dry when excessive refuse suddenly piles up on the traveling intake screen!

The Foxboro Traveling Screen Control System automatically starts the screen-rotating motor and the cleansing spray whenever refuse accumulation causes the water level difference between opposite sides of the screen to exceed a certain preset value. Quickly, it purges the screen of refuse and restores the intake level to normal —or sounds an alarm indicating that the cleaning mechanism is unable to cope with the difficulty. What's more, this action takes place only when the screen actually becomes clogged . . . no waste of power or unnecessary wear on mechanism through needless periodic operation.

The Foxboro Traveling Screen Control System is easy to install, inexpensive to operate, and pays big dividends in better intake operation, less maintenance and greater peace of mind. Write for complete information. **The Foxboro Company, 68 Neponset Avenue, Foxboro, Mass., U.S.A.**

ROTAX Liquid Level Controller. The heart of the system, translates level differential into operation of motors. In addition, it can operate warning horn or light in case of unusually severe fouling. Circular or rectangular case models.

FOXBORO INSTRUMENTATION

REG. U.S. PAT. OFF.

of possible complications, the following is now proposed: For small and medium-rated generators, the coolant is water (in the ducts) for stator and rotor with air in the internal surroundings. For larger machines, the combination is the same. For still larger machines, the coolant is water (in the ducts) for stator and rotor with hydrogen in the internal surroundings. In this way, complications associated with oil for the stator are eliminated, as are the problems associated with hydrogen for small and medium-sized machines. The coil ends for both stator and rotor would be cooled by the internal gas using suitable, small, internal-heat exchangers.

All internal water systems will be externally paralleled hydraulically. Then one external heat exchanger, circulating pump, etc, will be used for all.

Author suggests omitting the external deaerator. This was determined by tests on the hydraulic model of the turbo-rotor described at length.

Changes in the original suggestions of 1947 along with practical simplifications are outlined.

This 11-page paper covers a description of the hydraulic model of a liquid-cooled turbine-alternator rotor. *AIEE paper No. 50-28.*

Smoke Prevention

FLYASH COLLECTION FOR SMALL PLANTS, *by A A Petersen, Prat-Daniel Corp.* The small-plant owner is in danger of facing more stringent smoke and dust control ordinances. Boiled down, this statement means he will have to take steps to insure himself against violating the law in his community.

This paper is a review of various dust collectors with the advantages and disadvantages of each as they apply to dust ordinances.

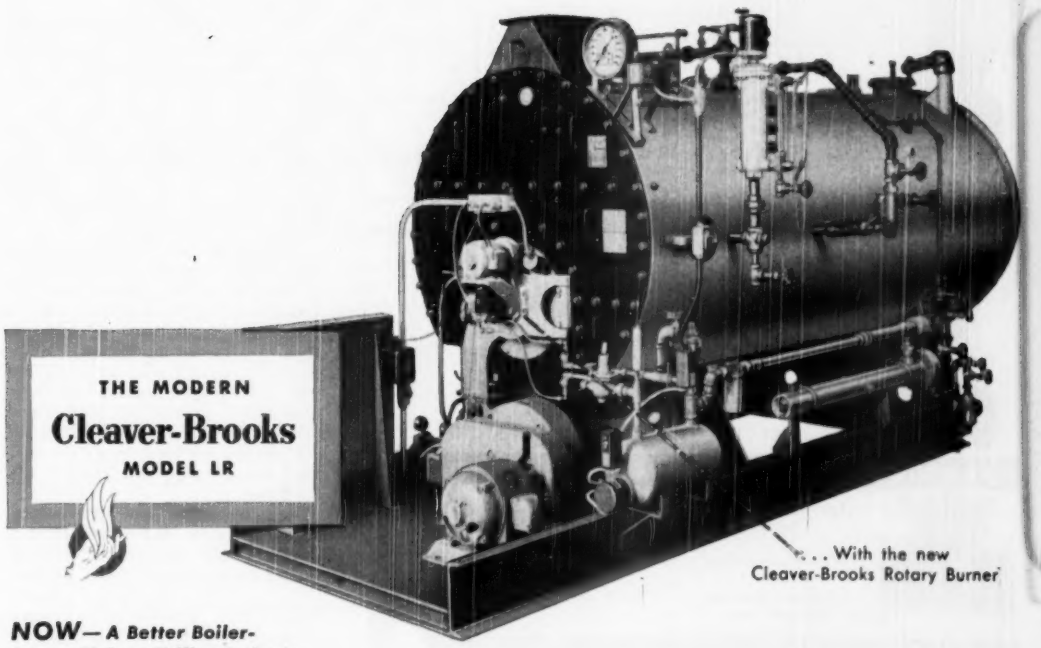
The settling chamber has until now been a very useful and widely accepted flyash-control device. Its only weakness is that its collection efficiency is not high enough to remove as much dust as the law requires.

The same can be said for the impingement, baffle or low-draft loss collector requiring no induced-draft fan. It removes dust well, but doesn't remove enough of it.

For the small plant the centrifugal collector has proved highly adaptable. There are various forms available but they fall chiefly into two classes: the first concentrates and separates out a high percentage of dust before the fan, while the second uses the fan rotor to concentrate and separate out the dust along an elongated scroll. Both recirculate the dust through a cyclone centrifugal collector. They are reasonably efficient on solids coarser than 325 mesh

Design

FOR PRODUCING STEAM



NOW*— *A Better Boiler-Burner Unit to Utilize Today's Low-Cost Fuels — Heavy Oil and Gas

The Cleaver-Brooks Model LR is a "trail-blazer" in modern self-contained boiler design and construction. It makes more effective use of today's low-cost fuels, (heavy oils and gas), and you are assured of better boiler performance.

A Brief List of Notable Features:

— the new Cleaver-Brooks rotary burner — simple — compact — precision machined — perfect mechanical balance — fully automatic — provides unprecedented flexibility in burning heavy fuel oils or industrial gases.

— single low-speed, low-power consumption blower furnishes both primary and secondary air for combustion—less weight and space requirements — reduction in sound levels.

— totally enclosed, drip and dust-proof panel for all major electrical controls.

— electronic combustion safety devices, dual low water cutoffs — are standard equipment.

— simplified design of combination gas-oil burner permits change-over from oil to gas or vice versa in less than a minute.

— improved design of boiler furnace and liberal heating surfaces provide greatest economy with all fuels.

— boilers of all-welded construction — meet standards of A.S.M.E. boiler code and leading underwriters — burner approved by recognized national agencies.

The Cleaver-Brooks Model LR self-contained boilers are of a highly developed four-pass fire tube design — tested and proved by factory and field experience on several thousand boilers of this type.

Write for complete specifications, dimension data, firing rates.

CLEAVER-BROOKS COMPANY
332 EAST KEEFE AVENUE
MILWAUKEE 12, WISCONSIN

Now Ready: Bulletin SG 142 contains detailed data and description of the MODEL LR. Send for your copy today!

KENNEDY
Underwriters' Approved
VALVES

When you need a Valve that's always on duty . . . always ready

Whenever life and property are at stake, the complete reliability and dependability that are built into every KENNEDY Valve are plus safety features. The valves listed below are approved by Underwriter Laboratories and Associated Factory Mutual Fire Insurance Companies.

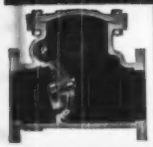
IRON BODY DOUBLE-DISC GATE VALVES

Fig. No.	Type	Sizes	Working Pressures
67	O.S.&Y. Screwed	2½" to 12"	Cold Water, non-shock, 175 lbs.
68	O.S.&Y. Flanged	2½" to 14"	2½" to 12"—Cold Water, non-shock, 175 lbs.; 14"—150 lbs.
681	O.S.&Y. Bell Ends	4" and 6" to 14"	Same as Fig. 68
701	Indicator Post Gate Valve—Flanged	4" to 14"	4" to 12"—Cold Water, non-shock, 175 lbs.; 14"—150 lbs.
702	Indicator Post Gate Valve—Screwed	4" to 12"	Cold Water, non-shock, 175 lbs.
70	Indicator Post Gate Valve—Bell Ends	4" to 14"	Same as Fig. 701

BRONZE VALVES

66	O.S.&Y. Wedge Disc Gate Valve	¾" to 2"	Cold Water, 175 lbs.
38	Hose Gate Valve no cap and chain	2½"	Cold Water, 175 lbs.
39	Hose Gate Valve with cap and chain	2½"	Cold Water, 175 lbs.
93	Angle Hose Valve	2½"	Cold Water, 175 lbs.
935	Angle Hose Valve	2½"	Cold Water, 300 lbs.

IRON BODY CHECK VALVES



125	Screwed Check Valve	4" to 6"	Cold Water, non-shock, 175 lbs.
126	Flanged Check Valve	4" to 12"	Same as Fig. 125
127A	Bell-end Check Valve	4" and 6" to 12"	Same as Fig. 125

INDICATOR POSTS

KENNEDY Indicator Posts provide a safe and easy means of operating valves installed underground or behind walls. Completely enclosed, operation is unaffected by rain, snow, or frost. Highly visible aluminum on black indicator, adjustable to valves of different sizes, protected by extra-thick moist-free glass. For wall or ground mounting.

Write for full particulars *Buy from Your Local Distributor*

THE KENNEDY VALVE MFG. CO.
1060 EAST WATER ST.
ELMIRA, NEW YORK
VALVES · PIPE FITTINGS · FIRE HYDRANTS

OFFICE-WAREHOUSES IN NEW YORK, CHICAGO, SAN FRANCISCO • SALES REPRESENTATIVES IN PRINCIPAL CITIES

(43 microns) but not always able to meet the fine dust requirements (20-43 microns).

One step further is the dust collector used in conjunction with an induced-draft fan. It gives excellent collection efficiencies. *ASME paper No. 50-S-31.*

FIELD AND LABORATORY METHODS OF AIR-POLLUTION STUDY, *by Paul L Magill and R W Benoliel, Stanford Research Institute.* Population of the three Pacific Coast states has grown 40 to 50% in the last ten years and the economy of the region has grown with it. Such rapid growth is bound to carry with it some evils. One is air pollution.

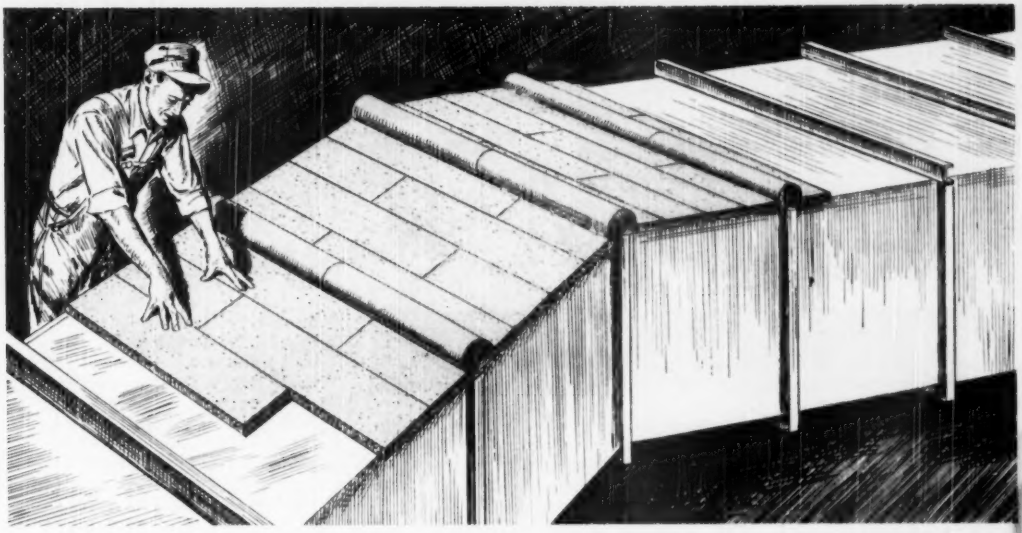
In Los Angeles, as an example, four million people live in a 1100-sq-mi area and it's affected by smog. Just what produces smog is still a question. But there are several factors that add to the problem.

There are 10,000 separate industries, more automobiles per capita than in any equivalent area in the world, a rubbish-disposal system employing backyard incinerators, a citrus-growing industry that uses smoky oil burners or smudge pots to guard against frost. When you put all this pollution into a section that has a unique weather phenomenon and topography you can expect a difficult problem.

Stanford Research Institute has run a fundamental smog investigation for the last three years. Method of attack involved is: (1) determining factors that affect the transport of pollutants from one location to another (2) locating the origin of pollutants and where they might go (3) studying the effects encountered because of atmospheric pollution (4) devising methods to catch and analyze air-borne impurities and then demonstrating their effect in the laboratory.

Both theoretical and experimental approaches were applied to step one, above. Closely studied was the work of Sutton, Bosanquet, Pearson, Thomas, Hill, Churchill, Maynard E Smith, Beers, Baron, Gerhard, Johnstone and others. Effects of stack height and of temperature were noted. Dispersion of gases from stationary stacks as well as moving vehicles is constantly under observation. Effect of prevailing winds (one direction by night, almost the opposite by day in the Los Angeles area) showed an effective stagnation of the atmosphere in which the pollutants concentrate.

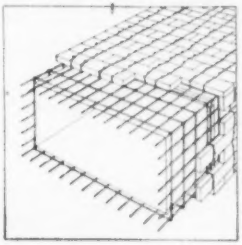
Contaminants in the air—over 40 appear regularly and at least 7 more occasionally—have been listed and identified. A modified venturi scrubber of the Pease, Anthony design was used to collect particulate matter, including sulfuric acid. *MWP paper. No number.*



What's wrong with this picture?

The block insulation on this outdoor high-temperature breeching is being applied directly to the metal surface between the channel-iron stiffeners. Each stiffener is then covered separately with a half section of pipe insulation. This method means extra work, and it doesn't allow any give in the insulation to take care of expansion and contraction of the breeching. As the breeching moves, cracks will appear in the finish, letting in the weather and reducing efficiency.

A better way to insulate a breeching like this is to weld 6" x 6" welded mesh over the stiffeners, then wire the insulation to the mesh. This eliminates the need to cover each stiffener separately. The mesh absorbs movement, allowing the duct to expand and contract without cracking the insulation finish.



There are breechings where it might be better to apply the insulation directly to the metal surface. The right method to use depends on placement and size of the stiffeners, expansion and contraction of the metal, and temperatures inside the breeching.

On almost any heat insulation job, choosing the right construction depends on careful analysis of every factor involved. Armstrong engineers can do this for you. These men are trained to come up with the correct answers to every insulation problem. Their advice can often make your job a better one and save you money as well.

In addition to engineering help, the complete contracting organization these men represent offers you both high-quality insulation materials and skilled workmen to apply them. Before you plan another heat insulation job, call the Armstrong office nearest you.

★ ★ ★

SEND FOR FREE BOOKLET

"People Make A Good Insulation Job" explains the operation of Armstrong's Contracting organization. We believe you'll find it interesting reading. Write for your copy to Armstrong Cork Company, Building Materials Division, 7006 Maple Avenue, Lancaster, Penna.

ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 300° F. BELOW ZERO TO 2800° F.

ASK ADSCO

to help you select the right

HEAT EXCHANGERS

Few heating or cooling problems are exactly alike. In some cases, standardized equipment can be adapted for installation, with substantial savings in cost and delivery time. On the other hand, many problems require specially designed units to meet specific operating needs.

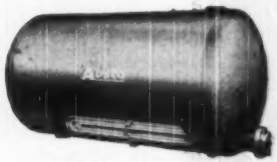
In either case, ADSCO can provide the right equipment, expertly designed and fabricated. ADSCO offers a complete line of standard or custom-made heat exchangers in a wide variety of types.

STRAIGHT-TUBE FLOAT HEAD HEAT EXCHANGER with Removable Bundle

This ADSCO unit has extensive applications in many fields. It can be furnished as shown or with non-removable bundle. Tubes may be of copper, stainless steel or special alloys. Shells may be fabricated of carbon, stainless or nickel-clad steel or copper silicon or other alloys.

INSTANTANEOUS WATER HEATER
Water Tube Type

ADSCO instantaneous heaters include: convertors, water heaters, condensate coolers, booster heaters, oil heaters, economizers, etc. . . . gravity or forced circulation . . . vertical or horizontal . . . steam or water tube type. Usual construction is steel shell with removable copper U-tubes. Thousands of these ADSCO heaters are in use today.



STORAGE HEATER

This heater, with removable U-tube element, can be furnished in either horizontal or vertical design. Shells are fabricated, per A.S.M.E. Code, of copper silicon alloy, stainless- or nickel-clad steel, galvanized or black carbon steel. ADSCO corrosion resistant treatment adds life to black steel tanks.

ASK ADSCO for expert engineering recommendations, drawings or estimates to meet your specific problems . . . or consult your ADSCO representative. No obligation, of course.

ADSCO

EXPANSION JOINTS — HEAT EXCHANGERS
STEAM TRAPS — STRAINERS — METERS
CASING — ANCHORS — GUIDES

Leaders Since 1877

AMERICAN DISTRICT STEAM CO.
NORTH TONAWANDA, N. Y.

Plant Problems

(*Continued from page* 132)

on 60 cycles. Main reason is the speed increase brings up new stress problems. I recommend approaching the whole problem with caution. *LT* may wind up with an expensive outlay without the good performance of a new 60-cycle unit.

C O VON DANNENBERG
Brooklyn, N. Y.

Tip For Single Phase

AS A RULE, 25-cycle transformers can be used on 60 cycles with good results. Usually, kva rating may be increased, the exact amount depending on each transformer. A 25-cycle transformer has more iron than the corresponding 60-cycle transformer. But if 25 cycles are put through a 60-cycle job, it starts overheating as soon as the primary is connected.

It is mighty difficult to predict change in efficiency and pf when going from 25 to 60 cycles. If single-phase motors are used, there is usually trouble with the starting device. It is designed to operate at a specific speed.

J I LACEY *Niagara Falls, N. Y.*

Cinch With Transformer

FIRST, NOTE that frequency change is headed in a favorable direction. Handy rule of thumb is that an upward change in frequency is always favorable. Here it means the machine (transformer or motor) has about double the amount of iron it actually needs at the higher frequency. Then if available voltages are higher than equipment ratings, rewinding or reconnecting is necessary.

If we keep applied voltage constant, and increase frequency, efficiency goes up and transformer kva rating holds about the same. Regulation is slightly poorer but this shouldn't amount to enough to cause trouble. Exciting currents will be smaller, which will result in lower losses when operating at light- or no-load conditions.

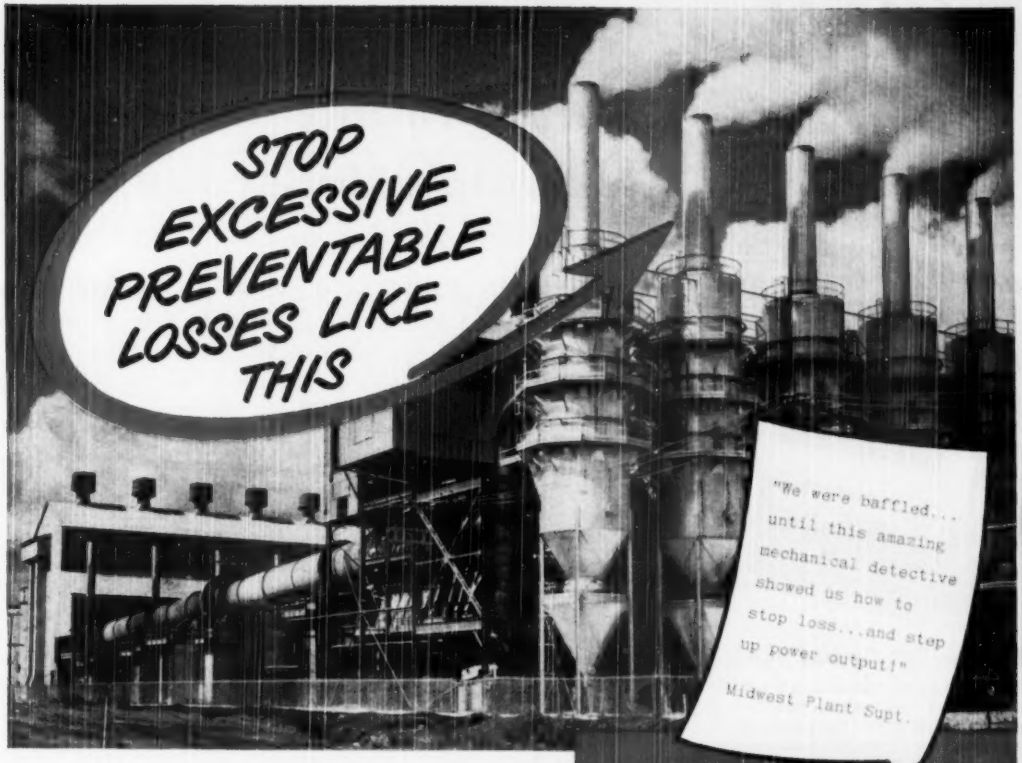
Now, consider the motor. Starting and maximum running torque are about one fourth rated, while speed is more than doubled. So resultant hp rating decreases to about one half the nameplate rating.

Major problem here is increased speed. Peripheral speed may be the limiting factor. It may also be possible to reconnect motor windings to increase number of poles thus reducing speed.

J DUCHARME AND H ROBERTSON
Worcester, Mass.

Vary F and V Together

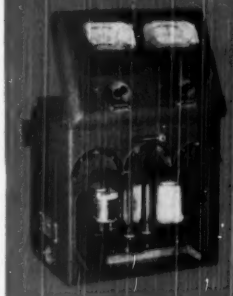
SURE, SPEED GOES UP, but keep in mind that voltage must be varied in proportion to frequency. If voltage and frequency are varied together, motor


STOP EXCESSIVE PREVENTABLE LOSSES LIKE THIS
"We were baffled... until this amazing mechanical detective showed us how to stop loss...and step up power output!"
Midwest Plant Supt.

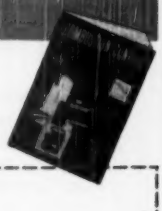
"For entirely too long our low power output had been a bothersome problem, till the lucky day the Cities Service engineer called to demonstrate the Industrial Heat Prover.

"We gladly accepted his offer to make a free analysis, and the results were miraculous! In almost no time he found the cause of our trouble—cracks in the brick work that caused large quantities of heat to be wasted. We made the necessary repairs, and increased our average power output by 22%!

"This Cities Service man is now one of our good friends. Might pay you to meet him too."



The Industrial Heat Prover is a flue gas analyzer. It tells you quickly and accurately how much efficiency you are getting from furnaces and heat production units.



FREE—For a complete description of the Cities Service Heat Prover mail coupon below for this free booklet.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

CITIES SERVICE OIL COMPANY
Sixty Wall Tower, Room 617
New York 5, New York

Please send me without obligation your new booklet entitled "Combustion Control for Industry."

*Name*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

Problem: How to Handle with Safety Highly Viscous Materials Under Pressure

Chemical engineers of many of the nation's largest industrial plants have watched with interest development of the NEW BS&B T-ASSEMBLY SAFETY HEAD. It is already in demand. It is recommended for chemical plants handling viscous materials.

No other relief device acts as quickly as the BS&B SAFETY HEAD. It consists of three principal parts . . . a pre-formed metal rupture disc and two specially designed holding flanges. Correct element resistant metals are used in fabrication of the rupture disc, which bursts when a predetermined pressure is reached. Instantly a fully unrestricted escape for gases and liquids takes place. And, as quickly the possible dangers of property damage, fires and injuries to personnel vanish.

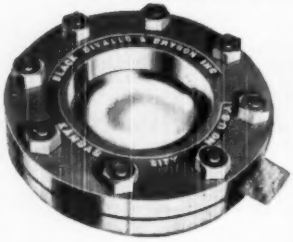
Send for This Catalog Now!

The BS&B SAFETY HEAD story is fully covered in a new catalog. Send for your free copy NOW! Use coupon on the opposite page. Once you understand your need for SAFETY HEADS, you won't delay.

Free Analysis Without Obligation

Jim Myers, SAFETY HEAD Sales Manager will have a BS&B engineer analyze your pressure relief problems and submit suggestions to you WITHOUT COST OR OBLIGATION. Mail coupon on opposite page or call GRand 8700, Kansas City, Mo. DO IT NOW!

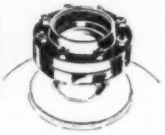
Do You need T-ASSEMBLY SAFETY HEADS?



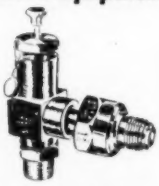
The answer is YES . . . to every chemical plant using viscous materials under pressure provided the liquid contacts the metal rupture disc. Such plants should not be without this new positive protection relief device. Read the details on "How a T-ASSEMBLY SAFETY HEAD Works" on the opposite page. This newly designed T-Assemly unit is the combined art of the highest achievement of metallurgical and engineering skill.

Here Are Your Answers to Relief Valve Problems--Extra Protection for Expensive Equipment

This installation is used when it is not necessary to have a shut-off or when materials handled are not toxic or inflammable.



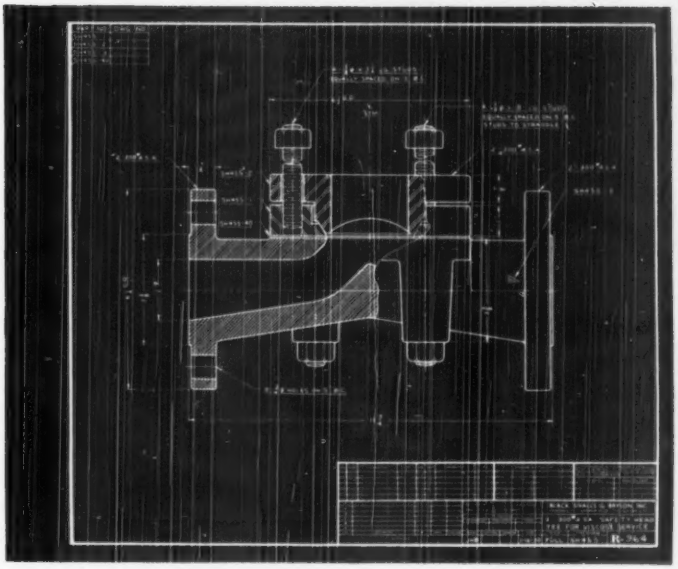
A SAFETY HEAD at the relief outlet will stop leakage until rupture disc pressure is attained. Not recommended where viscous or corrosive materials might contaminate internal parts of the valve. Investigate your valve design before using this type of installation.



A SAFETY HEAD under your relief valve isolates the valve from the vessel contents. This stops leakage through relief valve until SAFETY HEAD disc is burst by overpressure. An open bleed line or some type of telltale indicator must be installed in chamber between rupture disc and valve plug.

When the SAFETY HEAD is used as secondary relief device you are given positive protection when pressure rises to the predetermined bursting pressure of the rupture disc. The primary relief valve may fail to function due to corrosion, or pressure continues to rise due to inadequate relief area.

Solution: .... BS&B T-ASSEMBLY SAFETY HEADS



How the T-ASSEMBLY SAFETY HEAD Works

The shaded portions of the above diagram indicate a curved channel designed by BS&B through which the viscous material washes against the rupture disc. This material moves on through the passage if no undue pressure rise occurs. However, if the passage becomes blocked, such material will tend to solidify quickly, causing a dangerous pressure rise. In that case, the SAFETY HEAD rupture disc bursts and the pressure is given a fully unrestricted opening.

BLACK, SIVALLS & BRYSON, INC.

Special Products Division

KANSAS CITY • TULSA • OKLAHOMA CITY

BLACK, SIVALLS & BRYSON, INC.
720 Delaware, Sec. 2-6-6, Kansas City, Mo.

☐ Please send me a copy of the new BS&B SAFETY HEAD catalog.

☐ Please have a BS&B SAFETY HEAD engineer analyze my relief problem, without cost or obligation to me.

Name_____

Firm_____

Title_____

Address_____

City_____ Zone_____ State_____

BS&B SAFETY HEADS

develops same torque. With torque remaining the same, horsepower developed varies directly as frequency or speed.

Power transformers of 25-cycle rating can be used on 60 cycles without change. Same voltage and load rating should be applied on 60-cycle operation.

DEAN ANDERSON *Neenah, Wis.*

Try Paralleling Windings

A 25-CYCLE MOTOR can be used as a 60-cycle power supply. If 60-cycle voltage is the same as 25-cycle, motor output remains about the same. But speed varies directly as frequency. And if increased hp is no drawback, increase voltage in proportion to frequency.

Tabulated results for 10-hp 25-cycle 550-v 3-phase 750-rpm motor are:

	25 cycles	*60 cycles*
Hp	10	24
Design frequency	25	60
Design voltage	550	1320
Phase	3	3
Rpm (synchronous)	750	1800

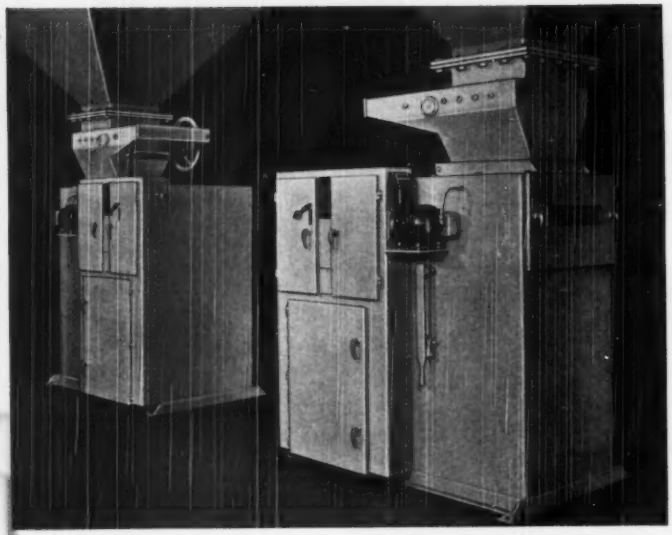
If increased voltage is a problem, consider reconnecting the motor with coils in parallel. In our tabulated case, this cuts supply voltage to 660. Now, if motor is operated on a 550-v 60-cycle circuit, it develops about double its old power—about 20 hp—and at a new speed of 1800 rpm at no load. In addition to changing to two circuits (or more) in parallel, possibly the motor, if originally connected Y, can be changed to delta. This automatically lowers the voltage required by $1 \div \sqrt{3}$.

Transformers fall under the same sort of reasoning. A 25-cycle transformer operates on 60 cycles without any changes and delivers full load with slightly poorer voltage regulation and temperature rise. But to work the core at its original magnetic design density, primary voltage should be raised in proportion to frequency. This, again, may not be convenient. It may be that primary and secondary windings can be divided in halves, then connected in parallel. This change would allow the transformer to give about twice its 25-cycle capacity.

J C NUTTER *Ontario, Canada*

Trim Rotor's End Ring

ASSUME ONLY FREQUENCY is to be changed, and resulting variation of speed and hp can be tolerated. Well, number of poles in motor remains the same in both cases. Motor speed is then $750 \times 2.4 = 1800$ rpm. Similarly, the new horsepower is $10 \times 2.4 = 24$ hp. But to get this rating and keep torque and other electrical conditions the same, line voltage must be increased by factor 2.4, or new voltage is $220 \times 2.4 = 528$ v. Usually voltage must remain the same. Alternative is to vary number of turns

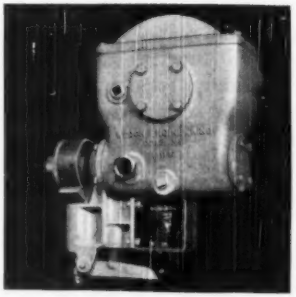


RELIABLE SCALE OPERATION IS ASSURED

with S-E-CO. COAL SCALES

Specially designed worm reducer with extra heavy bearings and gears, together with a standard frame, totally enclosed, ball bearing motor, assures reliable scale operation. In addition, such items as endless feed belt, heavy stainless steel hopper, and hardened steel parts, all contribute to make a unit which will run without failure day in and day out.

Reliability of operation is the outstanding feature of S-E-Co. Coal Scales. You need such units in your plant.



Write for bulletin.

STOCK EQUIPMENT COMPANY

715P Hanna Building ★ Cleveland 15, Ohio

per coil. In this case, number of turns must be decreased by the factor 0.417. Same effect can sometimes be realized by reconnecting the coils, but generally a complete rewind is necessary.

Now assume you want to maintain hp constant, and speed as near the same value as possible. Original motor has four poles. You can then go to an 8- or 10-pole 60-cycle job. Eight-pole motor speed is 750×1.2; 900 rpm and 10-pole motor speed is $750 \times 0.96 = 720$ rpm. For any change, final calculation can vary 10% from actual requirements without serious trouble.

Changes thus far have dealt with stator winding. But when changing frequency, rotor is also affected. Following changes must be made in rotor: For a squirrel-cage rotor, end-ring resistance must be changed. This may be done by decreasing cross section of each end ring about one half. If not done, motor takes an excessive current while starting and also takes higher full-load current. If motor is wound-rotor type, rotor must be treated the same as the stator.

Then, again, if motor speed is to be increased, mechanical construction of rotor must be checked to determine if rotor can operate at the higher speed without serious damage.

Efficiency of a 25-cycle motor, reconnected for a 60-cycle system, is generally somewhat lower. Efficiency of motor on 25-cycle system might be 80 to 90%; efficiency when reconnected is probably 70 to 80%. Power factor is also somewhat lower.

In general, transformers designed for 25-cycle system may be used on 60-cycle system without serious results. No changes in windings are necessary. Losses in transformer are somewhat greater on the 60-cycle system.

JAMES D RAMSEY *Godfrey, Ill.*

Actual Winding Data

SINCE THERE ARE many types of motors of different design, no one rule is even remotely reliable. The question of transformers is fairly simple. As a rule, the lower the frequency, the larger the transformer for a given output. A transformer for a certain output and frequency can be operated at the same output on a higher frequency. But a 60-cycle transformer will not operate well on 25 cycles.

Motor horsepower can often be increased on a frequency change. As a rule, 1½ times, and sometimes, under favorable conditions, twice the original rating. New speed cannot be exactly the same. For example, with a 25-cycle 1500-rpm motor, nearest speed under new conditions is 1800 or 1200 rpm.

Sometimes under favorable conditions it is possible to reconnect the coil groups. For example, a motor with 72

Let HARBISON-WALKER

help you solve

your REFRACTORY PROBLEMS!

HARBISON-WALKER
PRODUCTS FOR POWER PLANTS

Harbison-Walker offers a wide variety of high duty, super-duty and high alumina refractories in standard and special shapes, plastics, castables, mortars, insulating refractories and basic refractories for slag-top bottoms. Shipments are made from conveniently located plants or warehouses. Our technical organization will gladly help you select the exact grades and types of Harbison-Walker refractories best suited to your individual needs.

You get longer service from your boiler settings and reduce your maintenance costs when you select the correct refractories from the complete Harbison-Walker line.

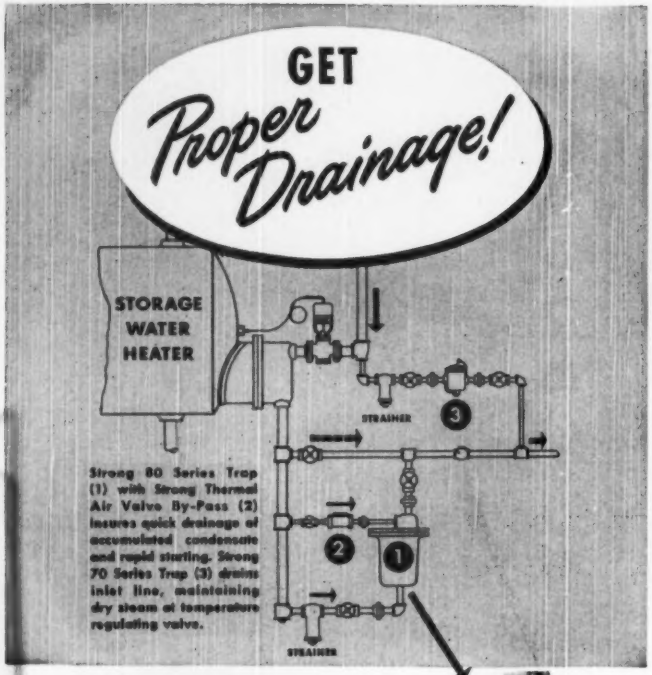
The grade of refractory needed depends upon the individual characteristics of the furnace—the type of boiler, fuel, method of firing, operating practice. The properties you want in your refractories include resistance to fusion, fluxing and erosion, spalling and mechanical damage.

Through many years of close association with boiler manufacturers and power plant operators, Harbison-Walker has gained intimate knowledge of service requirements.

For greatest overall economy and satisfaction, standardize on Harbison-Walker refractories!

TRADE MARK
REG. U. S. PAT. OFF.

HARBISON-WALKER REFRACTORIES COMPANY
and Subsidiaries
WORLD'S LARGEST PRODUCER OF REFRACTORIES
GENERAL OFFICES, PITTSBURGH 22, PENNA.



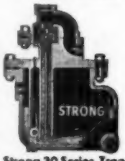
Strong 80 Series Trap (1) with Strong Thermal Air Valve By-Pass (2) insures quick drainage of accumulated condensate and rapid starting. Strong 70 Series Trap (3) drains inlet line, maintaining dry steam at temperature regulating valve.

PROBLEM: Condensate accumulates in coils due to lack of pressure when thermostatic regulating valve is throttling or closed. *Improper drainage and water hammer result when thermostatic valve opens.*

SOLUTION: *Drain coils fast.* Use trap with four to eight times capacity of actual steam condensate rate. For medium or high pressures, either open or inverted bucket traps are suitable. *Use open bucket traps for low pressures.*

Completeness of the Strong trap line enables our engineers to recommend exactly the type or size you need—open or inverted bucket, closed float, float-and-thermostatic (blast), etc., forged, welded, cast or semi-steel construction. Bring your drainage problems to us for solution. Send for Strong Trap Catalog No. 68 today for complete details of *all* Strong traps.

Strong 80 Series Trap for medium or high pressures.



Strong 30 Series Trap for high, medium or low pressures.

STRONG, CARLISLE & HAMMOND COMPANY
1392 West 3rd Street
Cleveland 13, Ohio

ANUM-METL Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES

Reducing Valve

70 Series Trap

Strainer

STRONG

slots, 2-layer winding, connected 4 poles, 25 cycles, gives a speed of 750 rpm. Winding has 12 groups of 6 coils each and full pitch as 1 and 19. Pitch is the number of slots between both coil sides. Winding is probably chorded (short-pitched), and wound 1 and 16. To change this to a 6-pole job means 18 groups of 4 coils each. Then full pitch is 1 and 13. Since coils are actually in slots 1 and 16, the new connection chords the winding about the same as before. Sometimes it is possible to raise all top coils, and spring them back 1 or 2 slots. New speed at 60 cycles, 6 poles would be 1200 rpm.

Rating can be increased in proportion to increase in speed, provided voltage is increased in the same proportion. But this generally calls for an odd voltage. Thus, if voltage were 550 at 25 cycles, voltage after reconnection should be 880. If the motor were originally connected star, it could probably be connected delta. This would give voltage of 508, which is somewhat closer to 550 v.

The foregoing shows this question is best decided on an individual basis. Cost of changes should be compared with cost of new equipment.

A ST. LAURENT *Quebec, Canada*

Starting Torque Is Low . . .

YES, BUT FIRST LET'S CONSIDER a few basic formulas. Synchronous speed of an ac motor is rpm $= 120f \div P$, where P is number of poles, f is frequency. Then reactance varies directly as frequency.

From the above, it is evident that both speed and reactance vary with frequency. Since winding reactance and resistance limit current flow, it is evident that both speed and reactance vary with frequency. Since winding reactance and resistance limit current flow, a change in reactance requires a change in impressed voltage to hold a given current in windings.

First, consider connecting the motor to a 60-cycle circuit with the same number of poles. Voltage applied to motor should vary directly with frequency. Motor speed also changes in that ratio. For a 2-pole 25-cycle motor, speed changes from 1500 to 3600 rpm. Assuming rotor and bearings can handle the higher speed, motor must be mechanically connected to give proper load speed.

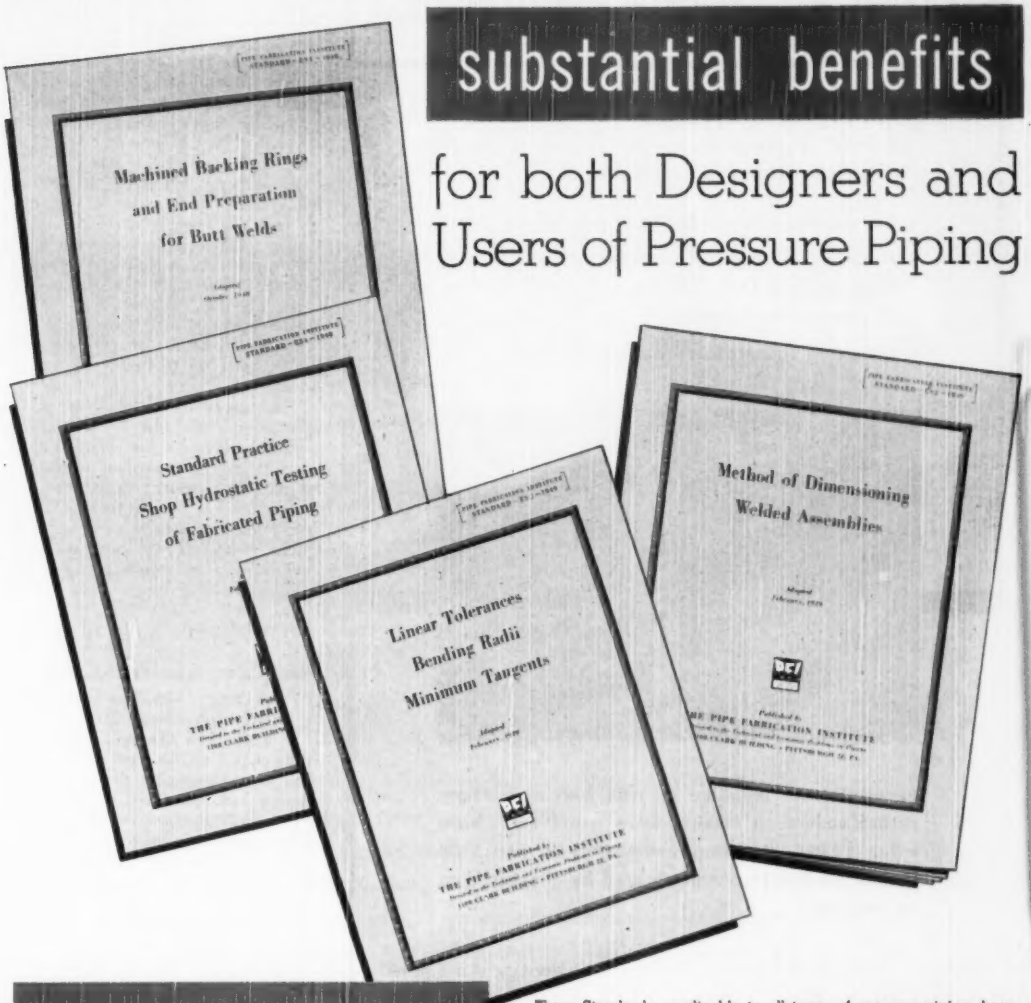
If impressed voltage is changed in the same ratio as frequencies, magnetic saturation of motor iron along with current flow is the same. Torque remains the same; hence hp increases as frequency ratio. Since current and magnetic density are about the same, pf won't change much.

Although hysteresis and friction losses are slightly higher, efficiency

These PFI STANDARDS have

substantial benefits

for both Designers and Users of Pressure Piping


Machined Backing Rings and End Preparation for Butt Welds
Standard Practice Shop Hydrostatic Testing of Fabricated Piping
Linear Tolerances Bending Radii Minimum Tangents
Method of Dimensioning Welded Assemblies
PFI
THE PIPE FABRICATION INSTITUTE

"Standardization ASSURES QUALITY and PROMOTES ECONOMY"

These Standards, applicable to all types of pressure piping, have been compiled by the PFI. Their purpose is to suggest standardized design features and procedures for designers, fabricators, contractors and users of pressure piping.

Designing engineers have found these Standards helpful in getting better piping and maximum value per dollar of cost. Also, they save time on the drawing board, in procurement of materials and during erection of the job.

The four Standards illustrated here have been issued so far, and more will be forthcoming. If you are concerned with pressure piping, you will find it to your advantage to have copies of these Standards. Simply fill in and mail the coupon.

The Pipe Fabrication Institute,
1108 Clark Bldg., Pittsburgh 22, Pa.

Please send me without cost the PFI Standards now available, also place my name on your mailing list to receive additional Standards as they are adopted.

Name _____

Title _____

Company _____

Address _____

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING • PITTSBURGH 22, PA.

Cut Refractory Maintenance

Sound engineering application of Bernitz Air-Cooled "Carbofrax" Blocks will eliminate trouble at the grate line of your furnace wall and insure:

- No troublesome clinker adhesion or slag erosion.
- Reduced outages for refractory repair, even with high sulphur fuels. Blocks in service as long as 20 years with no repairs.
- Increased furnace capacity and efficiency.

Bernitz Blocks installed on side wall of multiple retort underfeed stoker above grate line. Note after 11,000 steaming hours the Bernitz S100 Carbofrax Blocks are unaffected by clinkers, slag or erosion.

Bernitz Air-Cooled Furnace Linings • Bernitz Air-Cooled Spreader Stoker Piers • Bernitz-Nygaard Water Wall Armor for Walls and Arches • Bernitz Oil and Pulverized Fuel Burner Rings • Bernitz Water Gas Generator Linings

BERNITZ
FURNACE APPLIANCE CO.
89 BROAD STREET, BOSTON 10, MASS.
New York — Philadelphia — Syracuse — Atlanta — Pittsburgh — Cleveland — Cincinnati — Detroit — Chicago — Indianapolis — Minneapolis — Kansas City — Reno — Montreal — Toronto — Winnipeg

holds roughly constant. Reason is that increased speed gives better ventilation, reducing copper losses.

If another speed is desired, perhaps the motor windings can be reconnected for a different number of poles, maintaining the same chord factor or coil throw. Reconnecting may result in the need for an odd impressed voltage that would be impracticable. Any winding change should keep magnetic flux the same as originally. If this is done, pf and efficiency are about the same as before. Hp again varies with speed.

Thus, each motor would be an individual problem as to whether it should be operated at a different speed and voltage, reconnected or rewound. With the excess of material in a 25-cycle motor over that in a 60-cycle unit it is easier to reconnect or rewind the 25-cycle motor for 60 cycles than the reverse.

One other point to be careful of in a change of this sort is whether the squirrel-cage rotor has sufficient resistance to give the desired starting torque. It may be necessary to increase rotor resistance. For 25-cycle transformers on 60 cycles, core loss and exciting current are less, but eddy-current loss, copper loss, total loss, temperature rise and impedance all increase, assuming the same kva load.

V N Friedman *St. Louis, Mo.*

Easy for Squirrel-Cage

LT should buy the 25-cycle equipment provided reconnecting cost is figured in.

A 4-pole 220-v 750-rpm 25-cycle motor runs at 528 v, 1800 rpm on 60 cycles. But by reconnecting the stator pole-groups both speed and voltage can be cut in half and motor will deliver its approximate original hp at 900 rpm.

We have changed a 4-pole 750-rpm 25-cycle motor to a 6-pole 1200-rpm 60-cycle motor with parallel coil connections and a considerable increase in hp. Naturally, the new hp is a function of speed. Only an experienced motor winder should make the above changes.

We are assuming that squirrel-cage motors only are considered. Wound-rotor motors should have rotor poles changed to correspond to new speeds. Synchronous motors must have the number of revolving fields changed to meet the new speeds.

It is possible to rewind the 25-cycle motors for the new conditions with greater horsepower from the same frames. A good motor winder can easily calculate the size copper and number of turns from the original coils.

Transformers are designed for a definite ratio of voltage transformation. They should operate with 60-cycle power of the same voltage at a small increase in losses.

C Demere *Memphis, Tenn.*

OUT-OF-DATE in PIPING, TOO

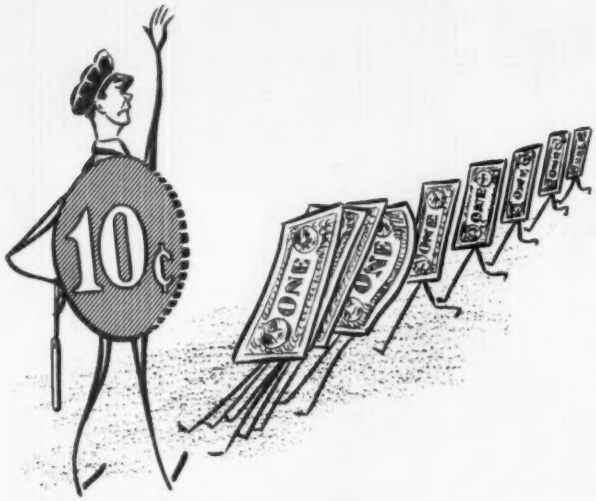
The old "washboard" method is a thing of the past just as it should be in the welded joints of piping. In the ordinary type welds, metal protrusions are formed on the inside of the pipe (even backing rings cause "humps"), which impede the flow. This causes steam, or whatever it may be, to pass through the pipe in a "washboard-like" manner, thus preventing maximum efficiency. The patented Mitchell-Westport Joint prevents these protrusions. It consists of a seal and anchor weld that completely prevents constriction of the inside diameter without sacrificing maximum bondage or strength. Although our shop prefabricated piping facilities can produce any type weld, we believe, after you've read our bulletin, "Something New in Welding," you'll specify the Westport Method for high pressures and high temperatures. Write for it today.

WESTPORT JOINT
(PATENTED)

REPRESENTATIVES IN BOSTON, NEW YORK
CLEVELAND, MOBILE AND HAVANA

W. H. MITCHELL & CO., INC.
2944 ELLSWORTH STREET
PHILADELPHIA 46, PA.
SINCE 1899

MITCHELL
PIPING FABRICATORS AND CONTRACTORS



"A DIME SPENT NOW *on proper design*
CAN STOP THE MARCH
of wasted coal dollars".

EQUIPMENT LASTS FOR YEARS
COAL FOR SECONDS

Fairmont Coal Bureau Engineers have the facts and figures on hundreds of plants that have been designed to efficiently burn Fairmont Low Fusion Coal.

Their "know-how" applied to your problem might result in lower steam costs for you.

Write today and have your name placed on our mailing list.

FAIRMONT COAL BUREAU
FAIRMONT REGION
WEST VIRGINIA
SERVICE TO INDUSTRY

MAIL COUPON TODAY!

FAIRMONT COAL BUREAU, Chanin Bldg., 122 E. 42nd St., New York 17, N. Y.

Kindly place me on your mailing list to receive copies of your publications and Technical Reference Bulletins.

P-6-50

Name _____ Company _____

Position _____ Nature of Business _____

Address _____ City _____ Zone _____ State _____

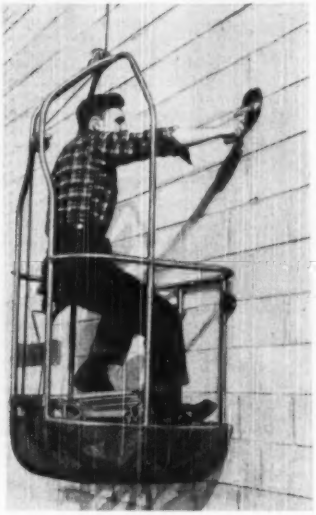
NEW EQUIPMENT

(*Continued from page* 152)

with nearly constant speed versus torque regulation. Another model is available for operation from 220 v line to control dc shunt motors up to one-sixth hp.

Power-supply cabinet, measuring 8x8x4 in., may be wall mounted. Control-station case, which may be mounted near motor or near operator's other hand-type controls, is 2x2x4⅛ in.

Servo-Tek Products Co, 4 Godwin Ave, Paterson, N. J.



PLATFORM HOIST **P633**

Rigid tubular-steel cage-construction makes the bosun's chair a strong, yet light one-man platform hoist, ideal for stack and tank repair or inspection.

Worker sits on a bicycle-type saddle with two coil springs and operates standard bicycle pedals that control a winch. The winch raises or lowers the hoist at a rate of 25 ft per min. Unit has a rated capacity of 625 lb, but weighs only 75 lb. It comes complete with 150 ft of ¼-in. 6x19 plow-steel wire rope.

Safway Steel Products, Inc, 6234 W Jay St, Milwaukee 13, Wis.

BRAZING ALLOY **P605**

Carbide facing for forged-steel pegs gives them a service life of 30,000 tons of coal in coal-pulverizer service. Use of Easy-Flo No. 3 silver brazing alloy along with a semi-automatic gas brazing setup permits application of the carbide facing.

Lucas-Milhaupt Engrg Co, 5057 So. Lake Drive, Cudahy, Wis.

PAINT ROLLS **P639**

Painting device uses a wool-covered hollow perforated-metal roll, kept supplied with paint under pressure. In one model, paint is in a small aluminum cylinder fitted with a spring-loaded piston pump.

It takes more than a want-ad to get a power plant auxiliary and an Induction Motor working together. But there is a brisk demand for Induction Motors that have operating characteristics required to keep auxiliaries humming in the modern power plant. The E-M 2-pole Squirrel-Cage Induction Motor is designed specifically for such dependable teamwork.

In the illustration above, there are two 250 hp, 3560 rpm E-M Heavy-Duty Induction Motors of drip-proof construction. They are driving boiler feed pumps in the Hunlock Station of the Luzerne County Gas and Electric Corporation at Kingston, Pennsylvania.

For years a supplier of *Synchronous Motors* for power plants, E-M applies this wide knowledge of power plant requirements to the design of large Induction Motors for special high-speed drives.

A half century of specializing in big motor engineering shows in the way E-M Induction Motors are built for the most dependable kind of performance year after year. They are a triumph of big motor engineering, with their sturdy rotors; the multi-layer, impregnated insulation of their stator coils; their long-lived, cool-running bearings; strong frames of rolled steel plate; quiet operation, and job-engineered external protection against environmental hazards.

For full information, see your nearest E-M Sales Engineer, or write for our Publications 189 and 190.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

1300 - TPA - 2065

E-M

SPECIALISTS IN
BIG MOTOR ENGINEERING

STEP-UP!

DRAINAGE CAPACITY WITH

Clark DUO-STEP Leverage STEAM TRAPS

Get the DOUBLE-LIFT that doubles steam trap efficiency!

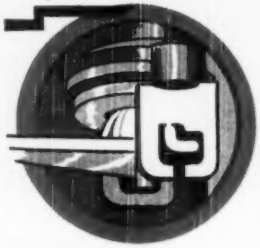
● It pays to be curious about the efficiency of the steam traps you are using. Are you getting the value you *can* and *should* get in terms of drainage capacity? Or are you paying a premium for the capacity you require?

Clark DUO-STEP is a *new* idea. It actually gives Clark Steam Traps *double* the drainage *capacity* of old-fashioned traps of equal size. And that means *double value!*

Find out about DUO-STEP *today*—and save the difference!

THE CLARK MANUFACTURING CO.
1831 East 38th St. • Cleveland 14, Ohio

Step 1 cracks the orifice



Step 2 opens orifice completely

Send for the story on Clark DUO-STEP Leverage today!

DUO-STEP Leverage

Clark FLUID CONTROLS

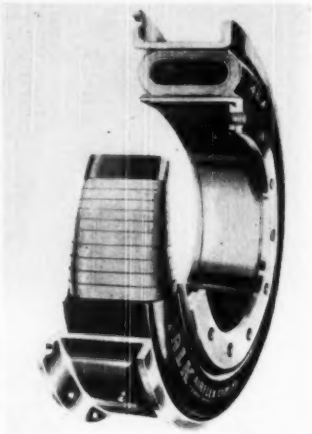
which forces out paint when valve is opened.

In a larger model, paint is in a pump-fitted can to which a long hose connects. The hose runs to a paint roll, which the painter moves lightly over the surface to be painted, in the same way as the small model is used. The small model holds 1 pint of paint, the large one 2.5 gal.
Rubberset Co, 56 Ferry St, Newark, N. J.

VERTICAL SPEED-REDUCER P653

Designated as Type ND (gear shaft downward) and Type NU (gear shaft upward), these units are particularly suited for agitator and mixers along with use in connection with supplementary low-speed, spur-gear drives without outboard bearings.

Continuous lubrication of gear-shaft bearing is ensured by displacement-type pump on shaft end. External radial or thrust loads are taken up in heavy tapered roller bearings.
Cleveland Worm and Gear Co, 3249-59 E. Eightieth St, Cleveland 4, Ohio.



FLEXIBLE COUPLING P642

This coupling has been redesigned after ten years of service. Improvement in rubber composition and bonding has increased torque capacity 20% above previous values. Hubs and adapter plates have been redesigned to facilitate disconnection and removal of the entire gland assembly.

Redesigned components are interchangeable with the equivalent ones of all couplings now in use, and standard parts may be combined to allow six different mounting arrangements including flange mounting on a flywheel. Stiffness factors can be controlled and are available for torsional analysis. This coupling is designed primarily for engine drives and for applications involving extremely severe torque fluctuations.
Falk Corp, 3027 W. Canal St, Milwaukee 8, Wis.

CONTROL CABLE P665

For 600-v operation and conductor operating temperatures of 168 F. Compared with

Continuing Metallurgical Study Produces Major Savings For Utilities

BACK some ten years ago, Kellogg's metallurgists, working with the turbine manufacturers, discovered that carbon-moly steel, which had been "killed" with less than half a pound of aluminum per ton, could readily be heat-treated at lower temperature to achieve the desired uniform acicular grain size for optimum elevated temperature strength.

This was, naturally, important as the demand grew for piping to withstand operating temperatures up to 950° F. But even more important was the later discovery that this steel showed practically no graphitization at this temperature. As a matter of fact, when graphitization troubles hit the utility industry in general during the early forties, *Kellogg* carbon-moly installations using this steel were found to be unaffected. Obviously this meant a saving of hundreds of thousands of dollars for those utility companies that had followed Kellogg carbon-moly specifications.

Today, to prevent graphitization at even higher temperatures (up to 1050° F.) chrome-moly steels have been generally adopted by the industry for main steam piping.

Functioning in the same pattern as they did a decade ago, Kellogg's metallurgical groups are currently working toward pin-pointing the *minimum amount* of chromium that can be used successfully in high temperature piping.

Specific and continuing development work is one of the many advantages that utility companies gain when they specify M. W. Kellogg high temperature and high pressure piping.

Illustrated — *photomicrograph (500 m.) of specimen indicating presence of graphitization.*

Special studies of unusual problems such as graphitization to assure long life and low maintenance.

Metallurgical research by recognized specialists who have made major contributions in this field.

Exclusive Equipment for accurately analyzing stresses in piping and providing unique data for critical installations.

Complete facilities for the fabrication of steel products from simple forgings to specially cast bi-metallic devices.

Top welding performance in shops and in the field by welders accustomed to working under X-Ray checks.

Quality control, devised by metallurgical experts, embracing forming, heat treating and non-destructive testing.

M. W. KELLOGG

Vessels
Exchangers
Condensers
Process Piping
Forged and
Welded Fittings
Radial Brick Chimneys

★

The M. W. Kellogg Company, Inc. (A Subsidiary of Pullman, Inc.) — Offices in New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris

. . . Having trouble with oil in Steam Condensate?

THE SPARKLER PROCESS

. . . reduces oil down to less than .25 p.p.m. in return condensate, the lowest of any commercial process, by employing Sparkler filters, together with other equipment.

This process is engineered to your requirements and our installation service men will be on the job to see that it works to both your and our complete satisfaction.

Write Mr. K. L. Carr, Sparkler Mfg. Co., Mundelein, Illinois for estimate of the cost of an installation for your power plant.

Filters used in one installation of this process that provides a flow rate of 200 gallons per minute.

SPARKLER MANUFACTURING CO.
MUNDELEIN, ILLINOIS

Makers of industrial horizontal plate filters for over a quarter of a century

conventional types of control cables polyethylene PNR is 25-30% smaller and 10-15% lighter.

Nylon is extruded over the polyethylene to add stability to increased ambient temperatures. There's a tough over-all sheath for the small diameter-control cable. It is chemically inert, and cable can be laid directly in acid or alkaline soils.

Rockbestos Product Corp, 550 Nicoll St, New Haven 4, Conn.

BOILER-FEED PUMP P644

A new single-suction, double-case, barrel-type boiler-feed pump is designed for 1200 to 250-psi pressure range. Design is based on tests of various types of volutes, return passages and impeller types and arrangements. This unit has back-to-back impellers and radially balanced double volutes in a split inner casing.

On the larger capacity pumps, the first stage has two single-suction impellers in parallel. Each takes one half the flow, which gives full advantage of a double-suction impeller in the first stage and permits operation at lower suction heads.

The pump has radial and axial balance and freedom from expansion in any direction as well as accessibility for maintenance. While the pump is intended primarily for boiler-feed service, it can be used for other high-pressure applications.

Allis-Chalmers Mfg Co, 864 South 70 St, Milwaukee, Wis.

PRESSURE-TESTING RIG P637

Simple equipment of this air-operated hydraulic-pressure generating device handles static-pressure testing of boilers, piping systems, compressor cylinders and similar pressure vessels. Developing up to 23,000 psi, it is also suitable for many types of laboratory destruction tests where extremely high pressures are involved.

Intensifier is compact, weighs only 80 lb and is mounted on two rubber tires for easy movement. Operation requires only connection of unit to any compressed-air line.

In operation, the intensifier draws oil

For positive valve sealing
...THE UNCONDITIONAL K & M BELLOWS SEAL!

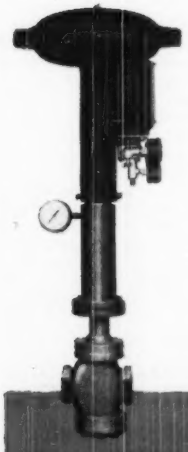
Designed by men who know automatic control valves, the K & M Bellows Seal is the ultimate in protection for valuable or toxic process fluids or in vacuum service where air infiltration would be serious.

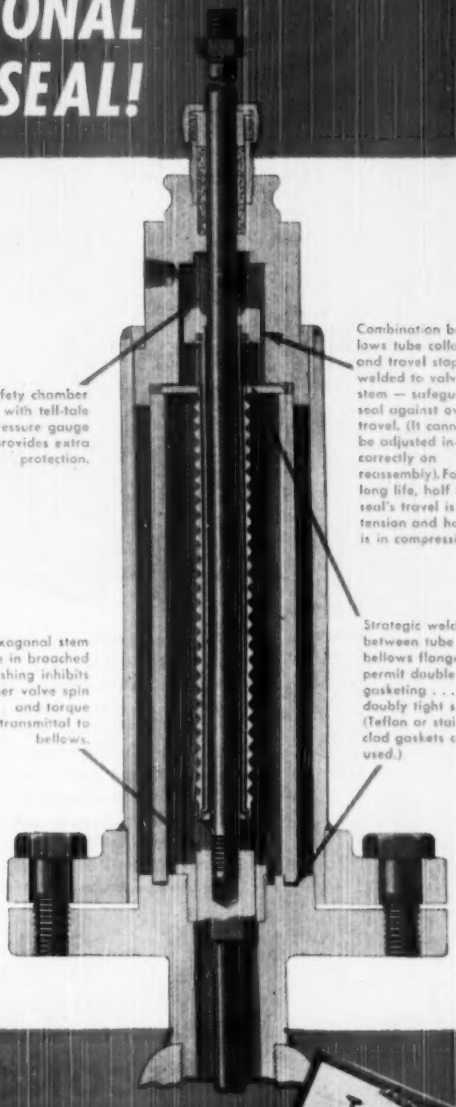
The seal is engineered to be unconditionally leakproof. Its efficiency is assured by its rugged simplicity . . . by ingenious functional extra safeguards inherent in the unique design of the seal itself.

Study the salient features as indicated on the cutaway view. Note also that the tube collar, the inner tube and the valve stem are positively sealed by welds — not threaded parts. The bellows, too, is sealed permanently at the bottom of the inner tube by a resistance weld; thus pressure is confined to the outside of the bellows where it can be more safely taken . . . furthermore, the bellows cannot buckle.

Here is the absolute seal between valve stem and valve body. Simple. Strong. Sure. Constructed of 3 ply Type 347 or 316 Stainless Steel, for pressures to 500 PSI and temperatures to 600° F. the K & M Bellows Seal is available with any K & M Diaphragm Motor Valve in sizes from ½ through 3 inches with full travel in each size.

Write for complete details.




Safety chamber with tell-tale pressure gauge provides extra protection.
Combination bellows tube collar and travel stop is welded to valve stem — safeguards seal against over travel. (It cannot be adjusted incorrectly on reassembly). For long life, half the seal's travel is in tension and half is in compression.
Hexagonal stem guide in broached bushing inhibits inner valve spin and torque transmittal to bellows.
Strategic welds between tube and bellows flange permit double gasketing . . . a doubly tight seal. (Teflon or stainless clad gaskets are used.)

KONTROL ESTABLISHED 1879
KELEY & MUELLER MOTOR
2821 - 43rd STREET NORTH BERGEN, N. J.

NEW! LOW PRICE M·R PUMP

...for Low Pressure Steam Heating Systems

NOW!

THE MOST COMPLETE LINE OF HEATING SYSTEM PUMPS IN THE INDUSTRY

CAPACITY UP TO 6,000 SQ. FT. E.D.R.
20 LBS. DISCHARGE PRESSURE • 9 G.P.M.
SINGLE AND DUPLEX UNITS

TYPE V-V VACUUM PUMP

TYPE E CONDENSATION PUMP

TYPES B AND C

TYPE S

Here's the foremost Pump Value, *in high quality features at a low price.* This MR Pump has hand-finished water passages, to minimize friction; impeller is rigidly and concentrically fixed on stainless steel shaft for perfect balance and vibrationless performance; pump casing equipped with bronze wearing ring—*a long-life feature seldom found in low-priced pumps;* prelubricated bearings; spring loaded bronze seal; motor and impeller assembly can be lifted by removing three bolts—*and without disconnecting any piping.* Write now for Bulletin CP-949.

HOFFMAN
• ECONOMY
TYPE M·R
CONDENSATION
PUMP

HOFFMAN SPECIALTY CO.

Main Office and Factory: Dept. P-6, 1001 York St., Indianapolis 7, Ind. • Representatives in Principal Cities

from its built-in supply reservoir. Variable static hydraulic pressures are preset by a simple turn of the regulator valve equipped with an air-pressure gage. Discharge pressures are visibly indicated on a large direct-reading gage. Any static pressure up to 23,000 psi can be quickly built up by using air pressures up to 90 psi.
Cooper-Bessemer Corp, 200 Thomas Ave, Mount Vernon, Ohio.

CABLE FAULT-LOCATOR P649

High-voltage dc impulse transmitter with pickup coil and detector designed primarily for locating faults on lead-covered cable installed in ducts. Has applications also on aerial and buried cable.

Set is essentially independent of the type of fault or its apparent resistance. It depends only on the impulse voltage required to break down the fault. Unit is rated up to 20 kv for use on all cable up to 15 kv and higher.
James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa.

TIME-DELAY RELAY P661

Relay is for use with a separate motor starter and pushbutton station to provide automatic restarting of a motor after a momentary voltage fluctuation or power failure of a few seconds duration. If power failure is prolonged more than a few seconds, the relay circuit times out, disconnecting the motor from the line.

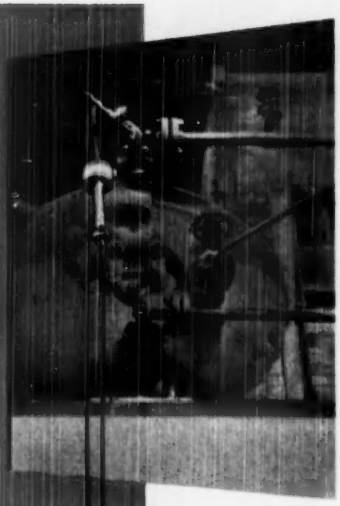
Automatic restarting of motors after a momentary power failure is particularly advantageous in textile or chemical industries where a shutdown might cause damage to material in process. In other applications such as oil fields, where motor starters are installed at widely separated locations, it is inconvenient and time-consuming to restart all motors manually each time a brief voltage fluctuation occurs.
Square D Co, Industrial Controller Div, 4041 N. Richards St, Milwaukee 12, Wis.

ALL-PURPOSE BELTING P643

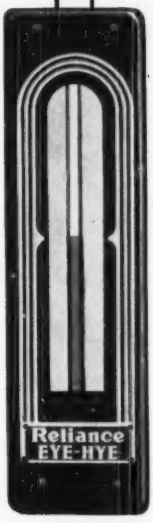
Designed to meet industry's demand for a single textile belting, it will handle all elevating and conveying requirements for practically all types of materials from food to gravel, and for power transmission. It is made from a specially woven cotton duck impregnated with neoprene compound.

This combination of heavy, tightly woven duck and neoprene impregnation gives extra strength and durability, also waterproofness, low stretch and shrinkage. It

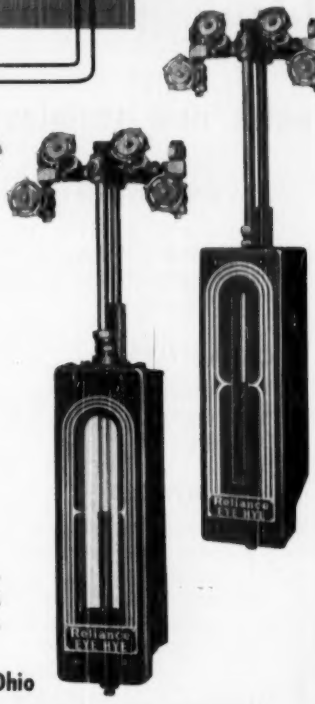
Why a remote reading gage



- Most boiler drums are high—direct gages are far from operating floor.
- Obstructions often make gages hard to see — necessitate special equipment or frequent climbing to inspect.
- Saves thousands of steps, hours of valuable time. Brings gage reading *down to eye level* at safe distance from boilers.



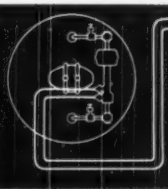
Why Reliance EYE-HYE



- EYE-HYE assures perfect measurement, dependability and clear reading.
- All-hydrostatic principle—no mechanical parts—no adjustments on location.
- Reads in liquid, like a conventional gage, but easier, faster because of illuminated green indicating fluid.
- Oldest practical remote gage, nearly 9000 in use, on land and sea.

One model for pressures to 600 psi. Higher pressure designs for pressures to 2,000 psi. Also long window model for wide liquid level variation—for tanks, heaters, etc. Write for Bulletin CO.

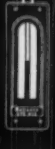
The Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland 3, Ohio



Reliance EYE-HYE®

Remote Reading Gage

All-hydrostatic • Reads like a tubular glass gage



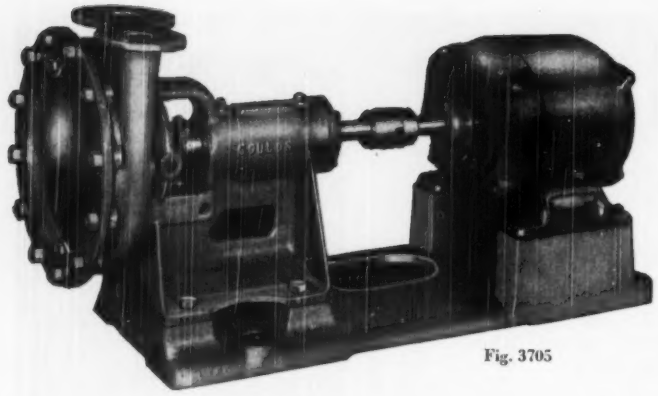


Fig. 3705

For Outstanding Service Handling Corrosive Liquids—

Goulds new stainless steel centrifugals

ADVANCED PUMP DESIGN—

The Goulds 3705 stainless line represents the last word in effective design. Fig. 3705 pumps will give you efficient, dependable, 24-hour service in handling corrosive liquids—at low cost.

CAPACITIES—

Goulds stainless steel centrifugals are made in 8 sizes with capacities to 750 G.P.M. and heads to 180 ft. depending upon capacity.

ADVANTAGES—

Exceptional efficiency (see Bulletin for performance curves) plus extreme simplicity make this an ideal pump for corrosive applications. High interchangeability of parts cuts stocking problem. Quick inspection or cleaning—simply remove casing cover without disturbing pipe connections.

Write for Bulletin 725.3 for complete details on this new stainless steel pump.

MEMBER HYDRAULIC INSTITUTE U.S.A.

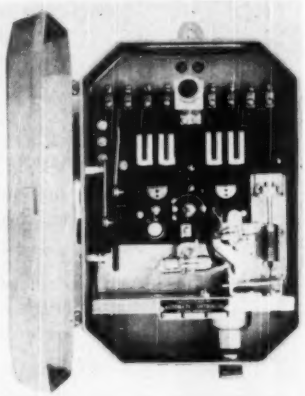
Goulds PUMPS INC. Seneca Falls New York

is sanitary. Because the weave is sealed against small particles, it is highly resistant to vegetable, mineral and fruit acids and oils, and is unaffected by grease. Can easily be washed in boiling water or steam, and can operate in high temperatures. Available in four styles, a variety of thicknesses, and widths up to 48 in.
Victor Balata & Textile Belting Co, 55 Park Place, New York 7, N. Y.

COAL LOADER **P641**

A heavy-duty loader requires no truck maneuvering if the truck is within the radius of the swiveling load-trimming discharge-conveyor. Model 544 is a heavy-duty pneumatic-tired loader, for 15-mph road speed. Easy control of loading is obtained by the hydraulically controlled trimmer. It loads highest trucks or longest trailers without requiring truck and driver to waste time jockeying into position.

Positive spiral feed and hydraulically controlled clean-up scraper make clean-up easy in big capacities; overload release prevents damage and reduces maintenance costs. Hydraulically controlled swivel conveyor swings, raises or lowers. Model 544 is mounted on special loader-type pneumatic-tired chassis.
Barber-Greene Co, 630 West Park Ave, Aurora, Ill.



PUMP-PROTECTING UNIT **P663**

Protectrol control prevents damage to pumps caused by their running without discharging water. This unit automatically stops the pump, and keeps it from starting until manually reset.

Emergency conditions cause unit to energize audible alarm circuit and light warning light. Unit is equipped with alarm silencer and automatic rest. Pushing manual reset button restores all circuits to regular operation.
Automatic Control Co, 1005 University Ave, St. Paul 4, Minn.

VERTICAL TURBINE PUMP **P640**

A small, vertical turbine pump, with glass-lined bowls and bronze impellers, can be used in deepwells as small as 4 in. in diameter. Equipped with vertical hollow-

WHAT CAUSES TUBE FAILURE?

When deposits are present, tube failure can usually be readily traced to the insulating effect of deposits on tube metal. The *proper* use of the *proper* water treatment will eliminate this problem.

In many cases, however, deposits are not present in failed tubes. Tube failure frequently results from mechanical action . . . poor circulation, steam blanketing, flame impingement, faulty design and similar troubles. In such cases, the cause of the failure often cannot be readily determined and careful investigation is required.

You can't overcome the problem if you don't know the cause!

The Drew System of Water Treatment eliminates guesswork. It starts with proper diagnosis. It includes recommendations for corrective treatment, and other preventive measures such as modification of operating cycles and redesign of equipment, if required. It is specialized service applied to your individual boiler problem.

Don't gamble with guesses! Consult the Drew Engineer or write for further information.

POWER DREW CHEMICALS

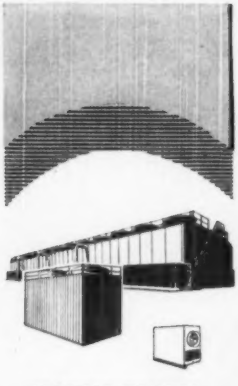
Power Chemicals Division

E. F. DREW & CO., INC.

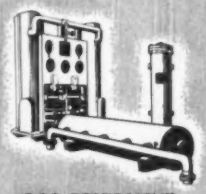
15 East 26th Street, New York 10, N. Y.

DREW PRODUCTS

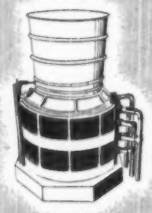
Nationwide service in Boiler Water and Cooling Water Conditioning



COOLING TOWERS

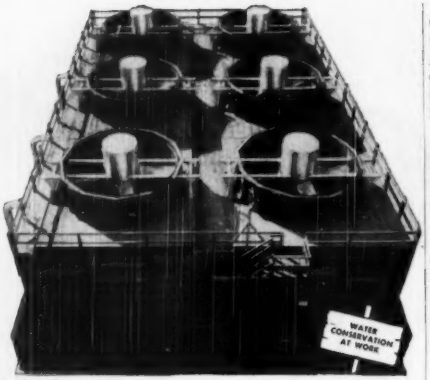


GAS EQUIPMENT



AIR COOLED HEAT EXCHANGERS

Producers of QUALITY Specialized Process EQUIPMENT



Pritchard INDUSTRIAL COOLING TOWERS Help You Save Water!

Wherever heat is to be dissipated to the atmosphere, you can depend on a Pritchard Cooling Tower to do the job more efficiently and economically at *water savings up to 99% over former wasteful methods!*

Adequately sized, thoroughly engineered and manufactured of highest quality materials, Pritchard Towers are guaranteed to meet your peak as well as your normal load requirements. Wherever you see a Pritchard Cooling Tower, you see water conservation at work.

Consult your nearby Pritchard representative for the solution to your water conservation problem.

Write for *FREE* Bulletins

EQUIPMENT DIVISION
J.F. Pritchard & Co.
Dept. No. 51 908 Grand Ave., Kansas City 6, Mo.

District Offices: CHICAGO • HOUSTON
NEW YORK • PITTSBURGH • TULSA • ST. LOUIS
Representatives in Principal Cities from Coast to Coast

shaft electric motor, this unit delivers 15 to 140 gpm. Design features include: adjustment on the drive head to change capacity or pressure in one simple operation; closely spaced synthetic rubber bearings and ¾-in. stainless-steel shaft.

Developed for small water systems and industrial plants it has an oversize foot valve to hold water in the column, assuring positive lubrication of all bearings and shaft journals. Valve face is rubber lined and mounted in an inclined position to prevent sticking or clogging by sand. Use of 5-ft column sections makes the pump easy to install, particularly where overhead room is limited.

A O Smith Corp, 3533 N. 27 St, Milwaukee 1, Wis.

PHOTOTUBE LIGHT SOURCE P658

General-purpose light sources have simple snap-on covers that make possible lamp replacement in about 20 seconds. Prefocused lamps are used throughout, assuring that the filament is in the proper position in relation to the transmitting lens of the light source.

Phototube holder is furnished complete with phototube, lens, masks and nine feet of connecting cable. For mounting convenience both a mounting clamp (providing 360 deg horizontal and 120 deg vertical adjustment) and a standard pipe thread for half-inch conduit are provided.

General Electric Co, Schenectady 5, N. Y.

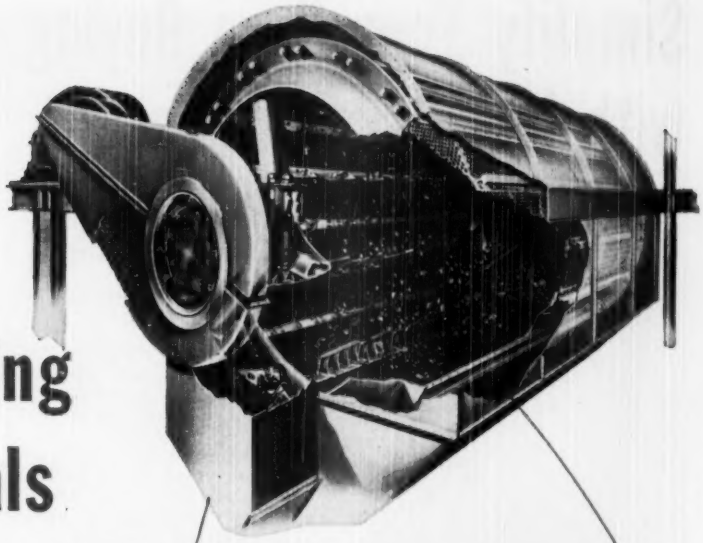
WALL-FIN RADIATOR P617

Multilength, *Wall-Fin* radiators in standard lengths from 2 to 12 ft in 6-in. increments are made up in steel, nonferrous copper or aluminum. Easily installed cabinets in unit lengths lock together with push-in rivets and a new hanger that rides with expansion and contraction of the heating element.

Trane Co, LaCrosse, Wis.

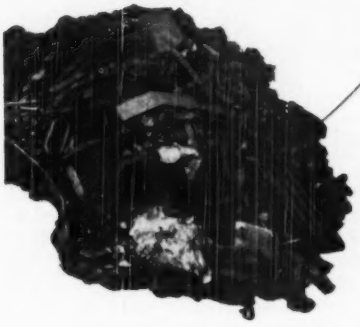
LEVEL INDICATOR P635

Illuminated-dial indicator, Model 240, operates from a 3 to 15 psi pneumatic transmitter or direct from valve-loading



Uniform, Free-Flowing Steam Coals

minus debris

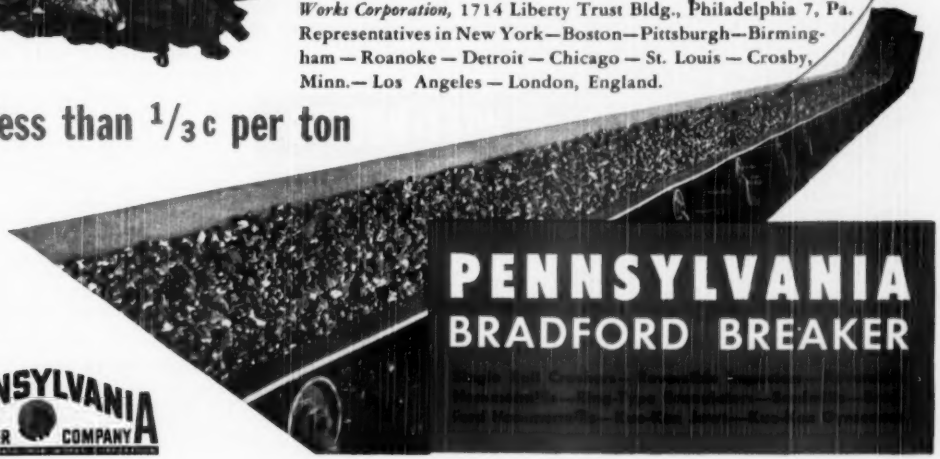


for less than 1/3 c per ton

Pennsylvania Bradford Breakers crush and clean ROM coals in *one* operation. Mechanically simple, the Pennsylvania Bradford is a big, revolving, screening cylinder fitted internally with deflecting lifting shelves. Coal, delivered to the feed end, is continuously lifted and dropped as the cylinder turns at an economical 12-18 RPM. Passing sizes escape through the screen holes immediately (no overcrushing), while larger lumps stay trapped until shattered by the constant drop impact. All debris larger than the screen perforations travels to the end of the breaker and is automatically scooped out by a plow. The result: a uniform product containing minimum fines, no oversize, no large debris—an ideal feed for efficient pulverizer and stoker operation. Debris elimination minimizes damage and shutdown of pulverizers.

Power demand of these Steelbuilt Pennsylvania Bradfords—less than ¼ HP per ton. Maintenance costs—less than $.001 per ton for parts *and* labor. For Central Stations and Industrial Plants; capacities up to 1000 TPH. Write for Bulletin 3007.

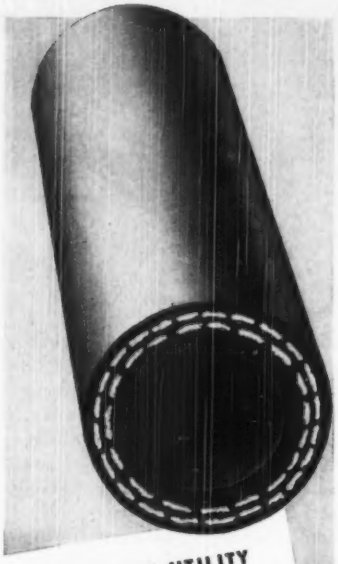
PENNSYLVANIA CRUSHER COMPANY, *Division of Bath Iron Works Corporation,* 1714 Liberty Trust Bldg., Philadelphia 7, Pa. Representatives in New York—Boston—Pittsburgh—Birmingham — Roanoke — Detroit — Chicago — St. Louis — Crosby, Minn.— Los Angeles — London, England.



PENNSYLVANIA
BRADFORD BREAKER

PENNSYLVANIA CRUSHER COMPANY

Simplify Your Hose Buying with Hewitt-Robins Servall®



New All-Service Hose Ends Need for Many "Special" Types

If your plant has many intermittent, light-duty uses for hose, Hewitt-Robins new Servall all-service hose is the efficient economical answer!

SERVALL IS IDEAL for handling air, water, moderate amounts of gasoline and oil, mild chemicals, low-pressure insecticides and the like. It solves the inventory and cost problems of buying many special hoses for infrequent use, and it ends the hazard of using a hose designed for only one service.

SPECIFICALLY, Servall is recommended for: All types of small air tools; for air cleaning and general air service; hot or cold water service within recommended working pressures; low-pressure spraying and fire-fighting; intermittent gasoline and oil service where the hose is not continuously filled; weak inorganic acids and alkalies and water contaminants; grease, paint (not lacquer) and insecticide spraying.

HERE IS MANY-HOSES-IN-ONE; dependable wherever and whenever a special heavy-duty hose is not required. Buy Servall. Buy it by the reel, use it as you need it. Think of the money you save!

SERVALL'S UTILITY IS BUILT IN

Molded and braided construction makes Servall tough and long lasting. Synthetic rubber tube resists gasoline and oil, acids and alkalies; carcass of high tenacity rayon provides a rugged, highly flexible wall; long-wearing red synthetic cover resists weathering and abrasion.

BULLETIN 137 gives complete data—ID, OD, working pressures, reel lengths, etc. Call your Hewitt Rubber distributor (see "Rubber Products" in classified 'phone book) or write Hewitt Rubber Division, 240 Kensington Ave., Buffalo 5, N.Y.

HEWITT-ROBINS SERVALL HOSE

HEWITT-ROBINS HR **INCORPORATED**

BELT CONVEYORS *(belting and machinery)* • BELT AND BUCKET ELEVATORS
CAR SHAKEOUTS • DEWATERIZERS • FEEDERS • FOAM RUBBER PRODUCTS
FOUNDRY SHAKEOUTS • INDUSTRIAL HOSE • MINE CONVEYORS • MOLDED RUBBER GOODS
RUBBERLOKT ROTARY WIRE BRUSHES • SCREEN CLOTH • SKIP HOISTS • STACKERS
TRANSMISSION BELTING • VIBRATING CONVEYORS, FEEDERS AND SCREENS

pressure to give sensitive, accurate readings of liquid level.

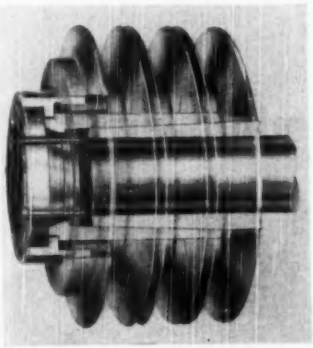
Units are available in multiples from 1 to 8 for flush panel mounting. A solid-red band on the translucent dial makes it easy to read from a distance. If desired, high- and low-level adjustable mercury alarm switches can be wired in series with a hermetically sealed standard Panalarm signaling unit. This lights up a red bull's eye and sounds a warning horn if levels get beyond selected levels.

Panalarm Prod Div, Panellit, Inc, 7218 N. Clark St, Chicago 26, Ill.

HAND HOISTS P638

Made in capacities from ½ to 4 tons, these hoists are compact, operate in close headroom, are light weight and easy to handle in tight places. Their construction features include a modern gear drive, Weston-type brake, steel load chain, steel housing, self-lubrication, and drop-forged top and bottom hooks. They have a high safety factor against possible impact loadings.

Wright Hoist Div, American Chain & Cable Co, 1100 East Princess St, York, Pa.



ADJUSTABLE-DIA. SHEAVE P601

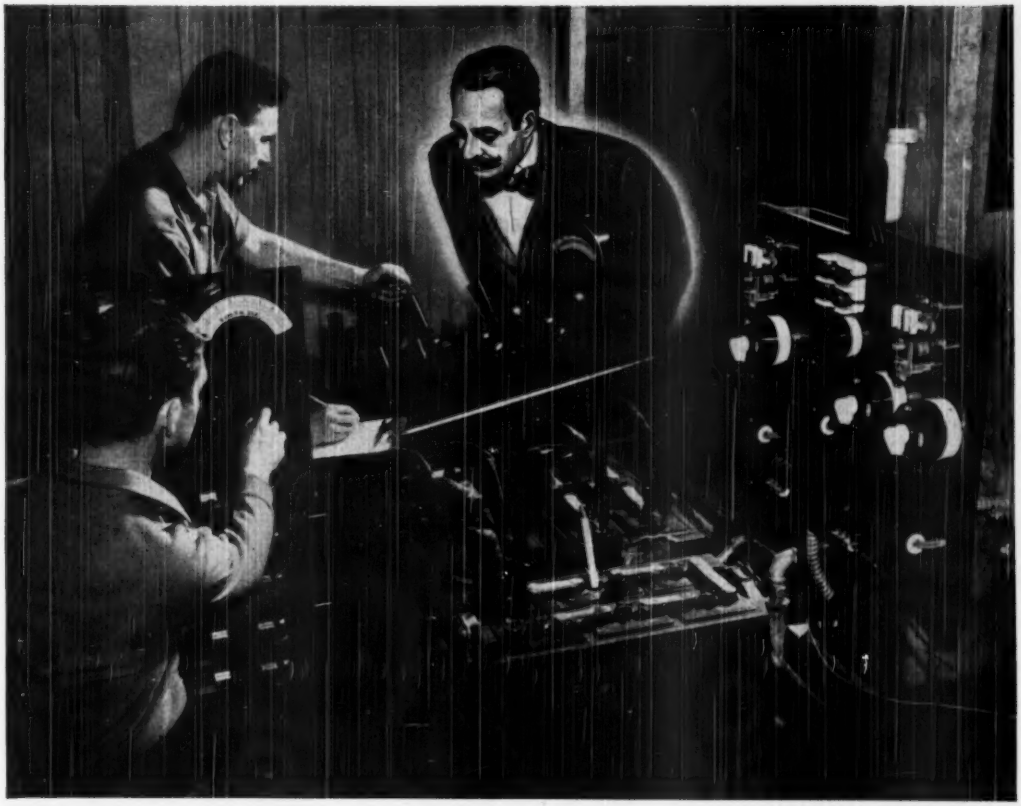
Adjustable-diameter V-belt sheave, has flanges mounted on taper bushing and sleeve. This double-taper hub, in addition to providing easy mounting and dismounting of the sheave, is designed to lock the unit rigidly into a single, solid sheave. Split-taper bushing provides easy handling, on and off the shaft, adapts the sheave to any shaft size and to positive clamping action on the shaft.

The split-taper sleeve locks the flanges to the hub to eliminate all flange looseness. Eliminating all operating clearances between hub and flanges of the sheave prevents vibration so factory-dynamic balance is constantly maintained. Simultaneous movement of all flanges, when settings are changed, maintains V-belt alignment.

The American Pulley Co, 4200 Wissahickon Ave, Philadelphia, Pa.

HEAVY-DUTY DIESEL P690

In the 195-375 hp range, the TS diesel can be made portable, but is not the automotive type. Unit is a 4-cycle 7-in.-bore 8½-in.-stroke single-acting engine with a



This overcharge test, Mr. Diesel, proves that Exides can "give it and take it"

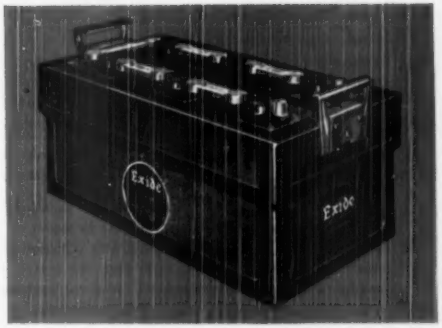
The Exide overcharge test is rough and rugged. Plates and separators are subjected to *continuous* overcharge . . . not for a short time, but as long as 48 weeks, and at an average temperature of 100° F. The purpose: to *make certain* that Exide Batteries give you maximum service life.

Results of this and other tests prove that you can count on Exide Diesel Cranking Batteries for:

- high maintained voltage—a *quick breakaway* and *high cranking speeds.*
- long life—low depreciation, less frequent replacements.
- low costs—operating, maintenance, repair.
- ruggedness for heavy-duty service in all climates.

Get top performance, long battery life and economy with Exide Batteries. Use them for all your Diesel cranking—buses, trucks, trailer-tractors, off-the-highway equipment, ships, power plants, Diesel-electric locomotives.

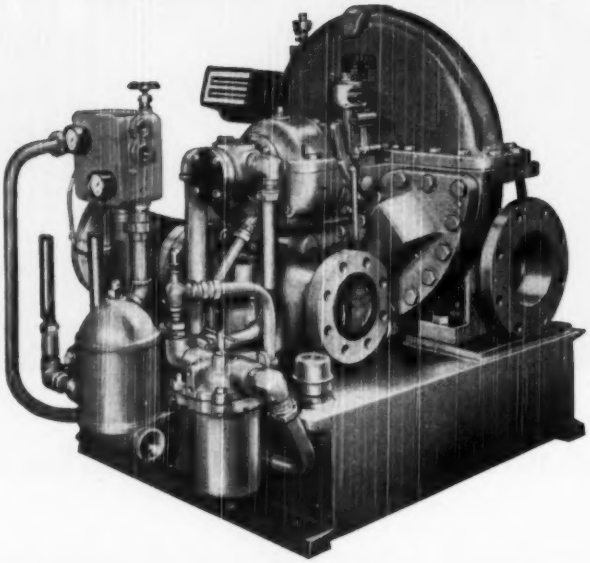
LET EXIDE'S ENGINEERING STAFF, the largest in the industry, help you find the right answer to any Diesel cranking problem.



THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto
"Exide" *Reg. Trade-mark U. S. Pat. Off.*

1888 . . . DEPENDABLE BATTERIES FOR 62 YEARS . . . 1950

MURRAY TYPE S VARIABLE SPEED TURBINE



Murray Type S Steam Turbines are well suited to a variety of jobs including those drives requiring variable speed. These turbines may be constructed with hydraulic type variable speed governors and complete pressure lubrication system including reservoir, filter, cooler, oil pressure gauges and thermometers.

Turbines so equipped are not only suitable for variable speed operation but for higher operating speeds as well. These features make the Type S variable speed turbine an ideal drive for high speed centrifugal compressors and blowers.

Pictured above is such a machine designed to deliver 400 HP at 7400 RPM. This machine is arranged for speed adjustment by means of hand control or by automatic control. The turbine is also equipped with a vibrating type speed indicator and a remote control tripout device. Note that the construction provides an oil tank of generous oil capacity. The combined base and tank arrangement may be extended for mounting the driven machine if desired.

Write today for full details

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY

weight of about 30 lb per hp. Fuel consumption is 0.40 lb per hphr. Engine is in the 900-1000 rpm range.

Normal starting is by 250-psi air admitted to all cylinders in turn through a starting-air distributor. Other methods of starting can also be furnished. Engine is designed for mounting either on a simple concrete base, or on welded-steel skids where portability is desired.

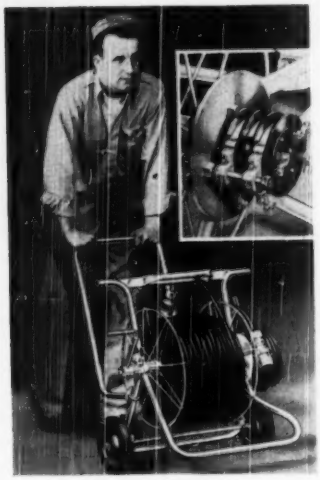
Ingersoll-Rand Co, 11 Broadway, New York, N.Y.

WATER TREATMENT **P636**

A powdered treatment, Formula 353, is said to be rapidly and completely soluble, with superior sludge conditioning and corrosion protection qualities for diesel or steam-generator service.

Formula 353 is a potassium-type treatment developed from laboratory research with a Vapor-Clarkson steam generator. It can be applied directly to water-storage tanks, automatically by chemical feeders or, with diesel locomotives, by using solution tanks and proportioning pumps.

Dearborn Chemical Co, 310 S. Michigan Ave, Chicago 4, Ill.



CABLE REEL **P651**

Model 3000 series *Powereel* is portable, saves labor, time, eliminates excessive cable wear. Unit is rated at 75 amp, 220 v, and is designed for use with any phase current. Collector ring permits winding or unwinding of cable without interrupting service. Reel comes with either 3 or 4 collector rings as standard. Standard models weigh 21 lb, and with special hand truck weigh 30 lb. Examples of capacity are: 300 ft of ¾-in. diameter No. 12, 4-conductor cable, or 3200 ft of 2-conductor shielded microphone lead cord.

Industrial Electrical Works, Dept A102, 1509 Chicago St, Omaha 2, Neb.

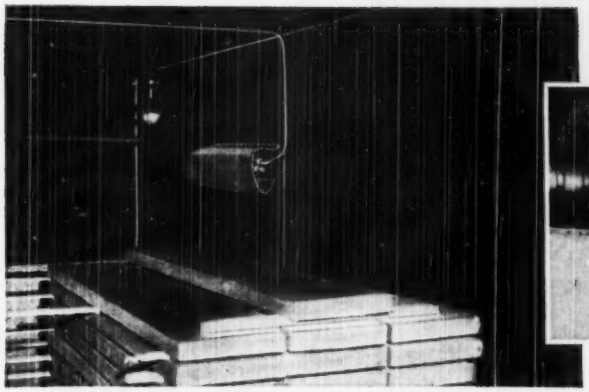
DIESEL-GENERATOR UNIT **P691**

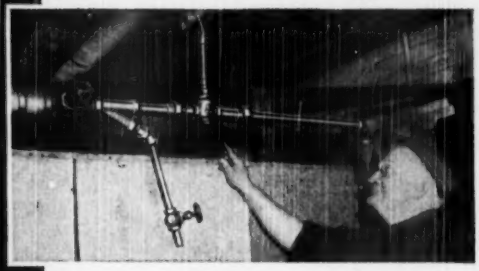
Sixty-cycle units are available in 40, 50, 60, 75, 100, 125, 200 and 250 kw ratings. There are similar units for 50-cycle oper-

Is a penny a day too much

FOR PERFECT KILN, OVEN OR ROOM CONTROL

1¢



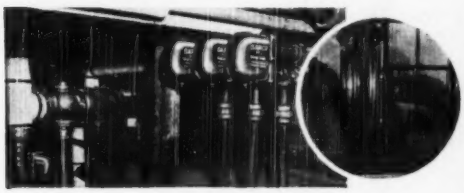


Mr. H. Klank, the maintenance engineer of the American Laundry Machine Company plant in Chicago says that this Sarco KR-14 Room Control has been on this wood kiln for 27 years without repairs. He ought to know, because he put it on there.

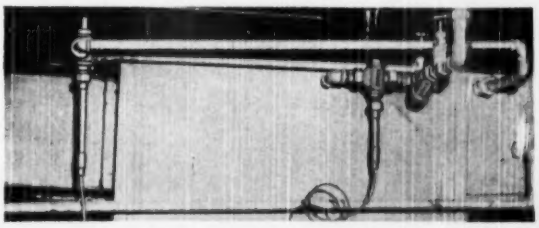
Recent reports include a Sarco Control in California overhauled after 24 years service and one in Cleveland in 25 years without repair and the owner figures that temperature control has cost him less than a cent a day.

OFFICE ROOM CONTROL

W. H. Barber, manufacturer of lubricating oils in Chicago, experienced difficulty with the office heating until the Sarco KR-14 room control with Sarco Float-Thermostatic Steam Traps were in stalled. Now "no trouble and don't expect any."



HEAT AND HUMIDITY CONTROLS



In baking, if it's not the heat—it's the humidity. This plant makes identical loaves of top quality bread day in and out because both heat and humidity of proof boxes are Sarco controlled.

LET THE SARCO ENGINEER NEAR YOU SUGGEST

274

SARCO SAVES STEAM

SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

THEY seal better... last longer...

BELMONT SHEET PACKINGS

Wherever flange and parallel surface joints must be connected for long trouble-free service — always select Belmont, the Better Sealing . . . longer lasting Sheet Packings. Long experience has made sheet packing manufacture a SPECIALTY with Belmont, that's why Belmont Sheet Packings are selected for every temperature . . . every pressure . . . every conceivable type of service.

You can get standard Belmont Sheet Packings — made of compressed asbestos, asbestos metallic, red rubber, cloth inserted, vegetable fibre and a wide range of other constructions. However, whether you require standard or special sheet packing, remember — you always get better sealing . . . longer life with Belmont.

CUT YOUR OWN GASKETS

WITH A BELMONT GASKET CUTTER

A portable tool for cutting 1¼" dia. to 19" dia. circular gaskets from all kinds of soft sheet packings. Rigid and simple to operate. Larger sizes only require cutter bar replacement.

483

THE BELMONT PACKING AND RUBBER CO.
Butler and Sepviva Streets
Philadelphia 37, Pa.

There's a Belmont Packing for every service

Rings · Spirals · Coils · Reels
Spools · Sheets · Gaskets

Steam · Water · Oil · Gas · Air
Acids · Alkalies · Ammonia

ation at a slight de-rating in kw capacity. These diesel-generators are designed for continuous service applications where the unit is the primary power source in addition to an emergency power source.

At full generator load, engine delivers from 68 to 76% of maximum horsepower available at that speed. Standard diesel-generator unit supplies 50-60 cycles, 3 phases, 3 or 4 wires.

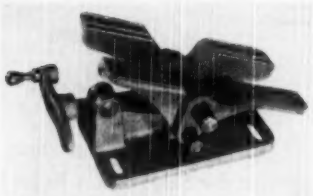
Cummins Engine Co, Inc, Columbus, Ohio.

VERTICAL BOILER P699

New low-cost line, 100- to about 600-lb-per-hr capacity, vertical, tubular, high-pressure (100-psi) boiler units are equipped with York gun burner, automatic control, low water cutoff, condensate-return system and draft adjuster.

Boilers are full-length-riveted, built to ASME construction, complete with base, combustion chamber and trim.

York-Shipley, 89 Jessop Place, York, Pa.



TILTING MOTOR BASE P654

Designed for fractional-hp motors, base has reversible mounting brackets for versatility of motor installation. Convenient handle allows adjustment of motor to desired position.

Gerbing Manufacturing Corp, 650 W. Washington Blvd, Chicago 6, Ill.

UNIT CONDITIONER P628

Six new models of industrial dry-coil vertical air conditioner are available in six sizes per model up to 25,000 cfm.

Heavy galvanized-steel casing has all seams *Everdur*-welded. Spiral, fin pipe, continuous cooling coils operate fully flooded with high- or low-pressure control or liquid-refrigerant pump recirculation. Low-pressure receivers have external float control.

York Corp, Roosevelt and Smith St, York, Pa.

FLUORESCENT FIXTURES P657

Eight-foot 2-lamp fluorescent lighting fixture together with 4-foot matching unit, both designed especially for continuous-row lighting applications in industrial plants.

The new 8-ft HFFS-296 fixture was engineered to simplify maintenance by the use of two 4-foot reflectors instead of one reflector running the entire length. Thus, one man can handle maintenance operations despite the new units over-all length.

Sylvania Electric Products Inc, 500 Fifth Ave, New York 18, N. Y.

PLANT EQUIPMENT NEWS

Reader Service Page for New Products and Literature

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

AIR CONDITIONING, HEATING, REFRIGERATION AND VENTILATION

A26 **UNIT HEATER**—Bulletin features Wing turbine-driven unit heater. Included are complete details of design and construction, together with engineering data and dimensions, both on revolving-discharge and fixed units. Piping details are also clearly shown. L J Wing Mfg Co, Linden, N. J.

A27 **SPRAY NOZZLES**—Catalog No. 30 lists spray nozzles and accessories for industrial and air-conditioning applications. Dimension data are given with explanatory illustrations. Industrial Div, Delavan Mfg Co, 3009 Sixth Ave, Des Moines, Iowa.

A28 **COOLING TOWER** — 4-page folder, No. AC-50, contains specifications, engineering data, and application of Marley Aquatowers, specifically designed to meet the demand for a compact, efficient, troublefree water-cooling tower. Marley Co, Inc, Fairfax & Marley Rds, Kansas City 15, Kans.

A29 **WATERCOOLERS** — 12-page booklet, No. 401, discusses direct-expansion watercoolers of U-tube construction designed to withstand stresses in materials due to temperature changes. Coolers shown use Freon-12 for the refrigerant. Doyle & Roth Mfg Co, 136-50 24th St, Brooklyn 32, N. Y.

A30 **FAN STANDARDS** — 32-page publication, No. 110, entitled "Standards, Definitions, Terms and Test Codes for Centrifugal, Axial and Propeller Fans," includes all information previously published in 4 separate bulletins, as well as new tables on size standards for various types of fans, and illustrations of revised fan arrangements. National Assn of Fan Manufacturers Assn Inc, 2159 Guardian Bldg, Detroit 26, Mich.

A31 **DIFFUSERS**—12-page bulletin, No. f-4085, furnishes engineering and performance data on the Barber-Colman line of Venturi-Flo ceiling air-distribution outlets. Barber-Colman Co, Rockford, Ill.

A32 **FANS AND BLOWERS** — 32-page catalog gives full engineering information, dimensions, performance and prices regarding all types and sizes of fans for industrial, commercial and residential applications. Chelsea Fan & Blower Co, Inc, 1306 Grove St, Irvington, N. J.

BOILERS AND AUXILIARIES

B43 **VERTICAL BOILER** — Bulletin ID-5044 gives general description and dimensions of the company's complete new line of low-cost vertical, tubular, high-pressure, boiler-burner units, sizes from 3 to 15 hp. York-Shipley, 39 Jessop Place, York, Pa.

B44 **FLYASH COLLECTOR**—6-page folder describes the new Buell "LR" flyash collector for efficient flyash prevention on small-boiler installations of limited draft. Size selection and dimensions are included. Buell Engrg Co, Inc, 70 Pine St, New York 5, N. Y.

B45 **CYLINDRICAL STEAM GENERATORS**—4-page bulletin, No. 50-2, contains a detailed summary of design and operating characteristics and operating test data on a 30,000-lb-per-hr Iso-Flow steam-generator installation. Petro-Chem Development Co, Inc, 120 E 41st St, New York 17, N. Y.

HOW TO ORDER ADDITIONAL DATA

Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each item of information you want, detach along the scored lines and drop the cards in the mail.

Example

Write here number of item in which you are interested → E17

Your Company Name: Brown Mfg Co.
Address: 3718 First Avenue
Pottsville, Okla.
Your Name: John Smith
Your Title: Power Engineer

POWER, 330 West 42nd St., New York 18, N. Y.

FILL OUT AND MAIL TODAY! NOT GOOD AFTER SEPT 1, 1950

Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 6/50

Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 6/50

Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 6/50

Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 6/50

Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 6/50

Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 6/50

Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 6/50

Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 6/50

D46 **BLOWDOWN SYSTEM**—4-page folder and chart show plant engineers how to determine the proper-size continuous blowdown system for an installation. Comments on advantages and disadvantages of various types of installations are also listed to assist the engineer in arriving at the most economical system for his plant. Hennessy Co, Watertown, Wis.

B47 **CYLINDRICAL FURNACES**—4-page publication, No. 50-1, describes and illustrates the Petro-Chem Inc-Flow furnace, radiant convection design. It also includes design and operating characteristics of these cylindrical furnaces. Petro-Chem Development Co, Inc, 120 E 41st St, New York 17, N. Y.

CONTROLS, MECHANICAL

E18 **ACTUATING CYLINDERS**—13-page booklet, No. 500, gives dimensions and weights, ratings and limitations of the Ledeen line of medium, heavy, and super duty pneumatic- and hydraulic-actuating cylinders. Ledeen Mfg Co, 1600 S San Pedro St, Los Angeles 15, Calif.

E19 **PROGRAM CONTROLLERS** — Bulletin CH-1 describes Wheelco Chronotrols, automatic time-temperature program controllers used in industrial processing of metals, chemicals, ceramics, etc, where the particular application requires a predetermined heating and cooling cycle to ensure product uniformity and minimize rejects. Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill.

E20 **TEMPERATURE REGULATORS** —Form No. 230 contains informative data on various types of adjustable, automatic and self-operating Barco temperature regulators. Barco Co, Inc, Empire State Bldg, New York 1, N. Y.

ELECTRICAL EQUIPMENT

F72 **DC MOTORS**—4-page broadside, No. PB-8200, Series 1-350 covers Elliott dc motors 250—6000 hp, high and low speed for direct, belt, or gear drive. Construction features are illustrated and a page is devoted to mechanical modifications, such as enclosed models and low-inertia mill-type motors. Elliott Co, Jeannette, Pa.

F73 **PRESSURE TRANSFORMER**—4-page folder, No. B250, describes and illustrates the Hagan differential pressure transformer, which is used for measuring differential pressure for indicating, recording and controlling the rate of flow of steam, gas or liquid fuel, water, etc. Hagan Corp, 323 Fourth Ave, Pittsburgh, Pa.

F74 **SWITCHBOARDS**—8-page bulletin, No. 18E6149A, features duplex switchboards for convenient centralized control, benchboards for concentrated control of meters and relays, and rectifier control cubicles for rectifier auxiliary equipment. Allis-Chalmers Mfg Co, 963 S 70th St, Milwaukee, Wis.

F75 **ELECTRICAL RESOLVERS** — 12-page booklet, entitled "ARMA Electrical Resolvers," covers 8 new miniature electrical resolvers and 7 others in 2 size groups developed particularly for electromechanical computing and control equipment. Arma Corp, 254 36th St, Brooklyn 32, N. Y.

F76 **CONTROL CABLE** — 4-page folder lists specifications and advantages of Rockbestos PNR small-diameter 600-v control cable. Typical applications are shown. Rockbestos Products Corp, 385 Nicoll St, New Haven 4, Conn.

F77 **LIGHTING GUIDE** — 32-page brochure, entitled "A Planning Guide to Improved Plant Lighting," covers the latest concepts of planned lighting, benefits to be gained, and methods to employ to put a planned lighting program into effect. Benjamin Electric Mfg Co, Des Plaines, Ill.

F78 **SWITCH CONTROL** — 8-page engineering data booklet provides detailed illustrations, descriptions and typical applications of the push-pull selector switch control. A target sheet to aid electrical engineers in plotting electrical control requirements is also included. Arrow-Hart & Hegeman Electric Co, 103 Hawthorn St, Hartford 6, Conn.

F79 **ELECTRIC GENERATOR** — Single-sheet form, No. 250-PCP, tells about a Katolight machine, which can be arranged to provide as many as 6 different frequencies. It gives odd frequencies such as 15, 25, 150 cycles, etc. Kato Engrg Co, 1415 First Ave, Mankato, Minn.

MAINTENANCE AND SAFETY EQUIPMENT

K31 **TUBE EXPANDERS** — 4-page folder, No. 71, contains list prices and illustrations of Wiedeke ideal tube expanders for rolling tubes in condensers, heat exchangers and other heat-transfer units with thin, thick or multiple tube sheets. Gustav Wiedeke Co, 1533 Richard St, Dayton, Ohio.

K32 **MACHINE REPAIRS**—24-page booklet, No. 45R7417, discusses care of ac rotating equipment. Contents are broken down broadly into preventive maintenance and machine repairs, including drying moist insulation, measuring insulation resistance, bearing clearances and proper machine applications, etc. Allis-Chalmers Mfg Co, 963 S 70th St, Milwaukee, Wis.

K33 **PRECISION LATHES** — 8-page catalog, No. L-10, illustrates and describes a new series of Light Ten South Bend lathes. Specifications and prices are given. Attachments and accessories are also listed. South Bend Lathe Works, South Bend 22, Ind.

K34 **PURIFYING OIL**—3 bulletins discuss solutions to power interruptions, engine breakdowns, and other utility problems resulting from contaminated turbine, diesel fuel and lube, and insulating oils. Honan-Crane Corp, 200 Superior Ave, Lebanon, Ind.

K35 **FIRE FIGHTING** — 12-page pamphlet, entitled "Abundant Wet Water for Fire Fighting," gives recommended fire-fighting techniques and informative data on the development of Pyrodyne "wet water" capsule and its automatic Hydroblender. Aquadyne Corp, 220 E 42nd St, New York 17, N. Y.

K36 **NOISE REDUCTION**—A series of bulletins, prepared for maintenance, safety, production and other executives of industry and business, tell how to solve noise-reduction problems on engines and compressors. Burgess-Manning Co, Libertyville, Ill.

K37 **TRAVELING SCREENS**—Application engineering data sheet No. 831-1 covers control of cleaning cycles for traveling screens. A schematic installation drawing and a typical

(Continued on page 196)

FIRST CLASS
PERMIT No. 64
(Sec. 34.9, P. L. & R.)
NEW YORK, N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4c. Postage Will Be Paid by—

POWER

330 West 42nd Street

New York 18, N. Y.

FIRST CLASS
PERMIT No. 64
(Sec. 34.9, P. L. & R.)
NEW YORK, N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4c. Postage Will Be Paid by—

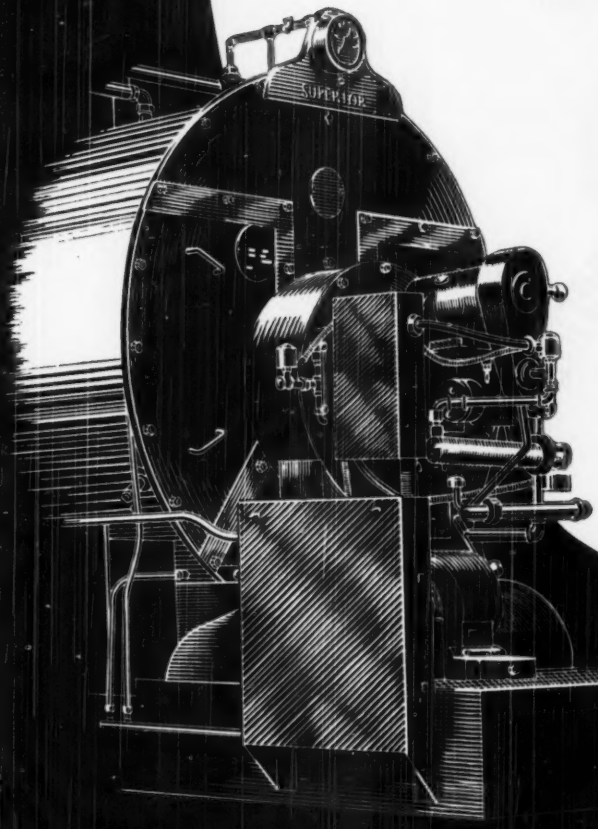
POWER

330 West 42nd Street

New York 18, N. Y.

For STEAM DIVIDENDS Tomorrow

Buy SUPERIOR STEAM GENERATORS Today



The operating economies which result from Superior's higher efficiency and long-lived dependability pay *real* dividends to their owners. Their thermal efficiency (guaranteed to exceed 80%) insures lowest fuel costs. Their rugged, heavy-duty construction spells years of dependable, trouble-free operation.

Fuel and maintenance savings are outstanding where Superior Steam Generators have replaced older equipment . . . but the greatest dividends result where Superior Steam Generators are specified for new steam plants. For here are added to their economy of operation (1) the economy of small space, (2) the elimination of an expensive stack (for Superior's induced draft requires only a vent for the products of combustion), and (3) simplified installation resulting from Superior's complete factory assembly and wiring.

There'll never be a better time to buy a Superior Steam Generator . . . because these dividends start with the first day's operation, and every day thereafter adds its dividend.

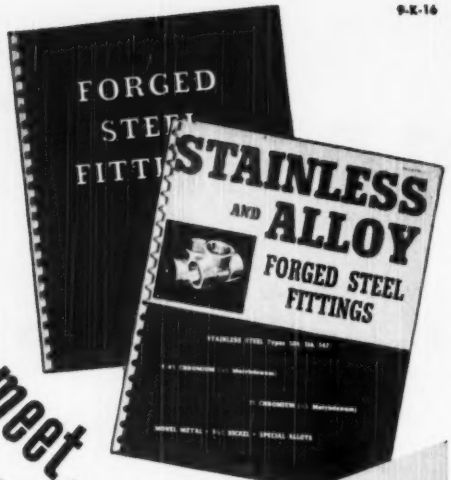
17 sizes from 20 to 500 b.h.p. for pressures up to 250 p.s.i. Fully automatic with all grades of oil or gas. For complete data write for Catalog 201.

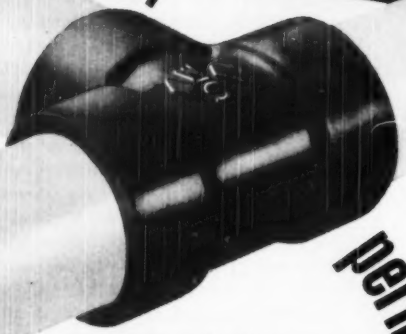
Superior Combustion Industries, inc.

Factory Emmaus, Pa.
Executive Offices Times Tower, Times Square, New York 18, N. Y.

9-K-16

Wherever pipes meet, permanently





IN POWER PLANTS,

the right answer to every temperature and pressure Fittings Problem is W-S Screw End and Socket Weld Forged Steel Fittings.

Basic materials are selected from a wide choice of chrome-moly, carbon and alloy steels. Designs are carefully engineered. Fittings are drop forged for strength . . . precision machined for accuracy of finish, and instrument inspected for perfection of threads, sockets, angles and concentricity. Investigate them today.

Write for Bulletin A3-50. For information on Stainless and Alloy Steel Fittings, ask for Bulletin S-1.

SOLD THROUGH LEADING DISTRIBUTORS EVERYWHERE

SPECIFY...

W-S

FORGED STEEL FITTINGS

DISTRIBUTORS PRODUCTS DIVISION, ROSELLE, NEW JERSEY

WATSON-STILLMAN Established 1848

Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

wiring diagram are among engineering details included. Foxboro Co, Foxboro, Mass.

K38 **METAL REPAIRS**—4-page issue of **METCO News,** Volume 5-#1, shows how metallizing saves money on turbine repairs. Typical applications are illustrated. Metallizing Engrg Co, Inc, 38-14 30th St, Long Island City 1, N. Y.

MAINTENANCE MATERIALS

L53 **REFRACTORY CONCRETE** — 24-page booklet, revised edition, entitled "Lumnite Refractory Concrete," contains detailed information on refractory concrete mixes—proportions of Lumnite and various aggregates—and tables for selecting proper types for a wide range of temperatures and insulating conditions. Lumnite Div, Universal Atlas Cement Co, Chrysler Bldg, New York 17, N. Y.

L54 **OIL SEALS**—16-page handbook, entitled "Johns-Manville Clipper Seal," is divided into sections on the principle of Clipper seals, their construction, advantages in various applications, installation data, and other information of interest to oil seal users. Johns-Manville, 22 E 40th St, New York 16, N. Y.

L55 **REFRACTORY CEMENT**—Bulletin No. R-49 lists applications and qualities of R & I Moldit-D refractory cement. Illustrations are included. Refractory & Insulation Corp, 120 Wall St, New York 5, N. Y.

L56 **PACKING**—3 publications describe Walker's line of Lion Twin-Pak ring packing; Lion Shallex packing for shallow stuffing boxes; Lion Unilip and Two-Lip heavy-duty hydraulic packings. Design features and service recommendations are given. James Walker Packing Co, Inc, 96 Liberty St, New York 6, N. Y.

L57 **ANTIRUST PAINT** — Single-sheet contains price schedule and specification list on Speco Rustrem, antirust paint, which can be applied over rust without wire brushing or scraping. Speco, Inc, 7308 Associate Ave, Cleveland 9, Ohio.

L58 **BEARING BRONZE**—2 bulletins, No. 150 and 250, cover semi-finished die-cast bearing bronze shapes and special bar stock sizes up to 19-in. OD, up to 40-in. long solid, and up to 20-in. long cored. Magnolia Metal Co, 18 W Jersey St, Elizabeth 4, N. J.

L59 **EXTRACTORS**—8-page leaflet features Reps pipe and stud extractors. Tells how they work, gives prices and a list of recommended sizes. Reps Tool Co, Box 5, Elmwood Branch, Hartford 10, Conn.

L60 **SELF-LOCKING RINGS** — 6-page broadside, No. 5, consists of a series of Waldes Truarc self-locking rings. Complete engineering data, specifications, and typical applications for each ring type are given. Truarc Sales Div, Waldes Kohinoor, Inc, 47-16 Austel Place, Long Island City 1, N. Y.

MATERIALS HANDLING

M36 **CONVEYOR SYSTEM** — 6-page bulletin, No. 3849, describes the company's new, precise proportioning and blending system, heart of which is the Conveyometer, a self-testing feeder-weigher designed for "stream" delivery of small, crushed, granular or nonflushing, ground materials. Richardson Scale Co, Clifton, N. J.

M37 **DIESEL TRACTOR** — 29-page booklet, No. 12676, explains quality features of Caterpillar D8 diesel track-type tractor. Illustrations and specifications are included. Caterpillar Tractor Co, Peoria 8, Ill.

M38 **VIBRATORY FEEDERS** — 16-page catalog covers the Syntron line of Vibra-Flow vibratory feeders, long conveyors, multiple magnet models, furnace feeders, infrared dry feeders, etc. Syntron Co, 492 Lexington, Homer City, Pa.

M39 **ELEVATORS** — 24-page pamphlet, entitled "Vertical Transportation," gives informative data and

CARNEGIE-ILLINOIS STEEL CORPORATION'S Irvin Works is one of the largest most modern finishing mills in the nation. Its Boiler Plant was originally constructed and has been progressively modernized by Dravo Corporation. The latest extension, a complete, new boiler facility, is but one of ten major power projects currently being constructed by Dravo.

DRAVO
CORPORATION

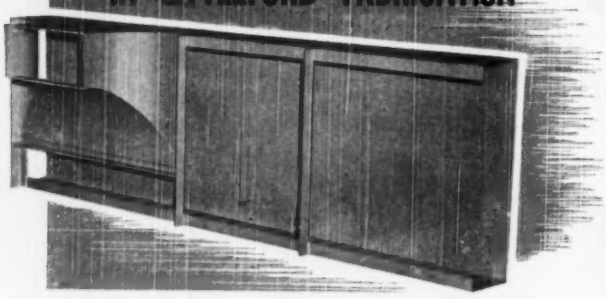
DRAVO BUILDING, PITTSBURGH 22, PA.

Engineering constructors of power plants, boiler plants, central stations, compressor stations, water pumping stations. Fabricators and erectors of power piping. Machinery installation. Power and boiler plant equipment.

PITTSBURGH · PHILADELPHIA · CLEVELAND · NEW YORK · DETROIT

Don't Gamble....

GET PRICE AND QUALITY IN LITTLEFORD FABRICATION



You get superior work because Littleford for 68 years has been fabricating power house equipment, large jobs and small, in any quantity, in any weight or kind of metal. You win by our unusual facilities and skilled craftsmanship. You pay for no trial and error at Littleford, because we really know how! Send specifications and let us quote on your next job.

FABRICATORS OF PLATE AND SHEET METALS

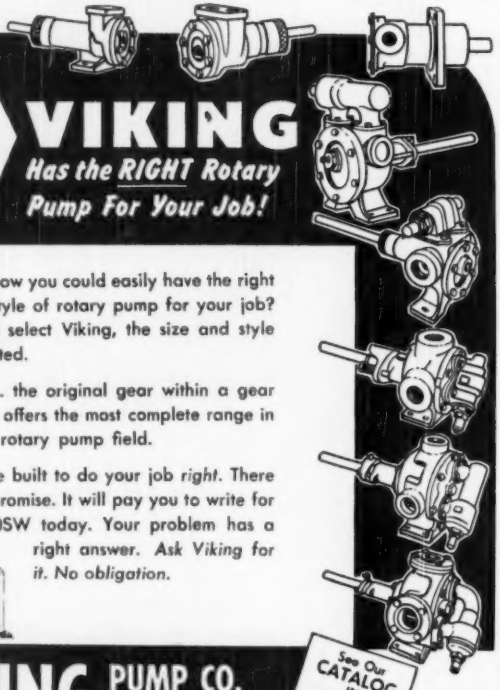
LITTLEFORD

LITTLEFORD BROS., INC.
438 E. Pearl St., Cincinnati 2, Ohio

DUCT WORK—BREECHINGS
ELECTRICAL ENCLOSURES
TRANSFORMER HOUSINGS AND TANKS
CONTROL DESKS AND INSTRUMENT PANELS
CUBICLES—PIPING—CABLE PANS

DO YOU KNOW

VIKING Has the RIGHT Rotary Pump For Your Job!



Did you know you could easily have the right size and style of rotary pump for your job? When you select Viking, the size and style is not limited.

Viking . . . the original gear within a gear rotary . . . offers the most complete range in the entire rotary pump field.

Vikings are built to do your job *right*. There is no compromise. It will pay you to write for bulletin 50SW today. Your problem has a right answer. *Ask Viking for it. No obligation.*

VIKING AN HONORED NAME IN PUMPING

VIKING PUMP CO. Cedar Falls, Iowa

See Our CATALOG IN SWEETS

illustrates the Otis line of passenger elevators, escalators, freight elevators, dumbwaiters and company services. Otis Elevator Co, 260 11th Ave, New York 1, N. Y.

MECHANICAL TRANSMISSION

N25 **FLEXIBLE COUPLINGS** — 2 bulletins are offered. No. 8105 contains construction features, method of selection, and dimensions of Falk Airflex couplings for frequent high-torque load fluctuations. No. 8100 illustrates typical installations of same. Falk Corp, 3001 W Canal St, Milwaukee 8, Wis.

N26 **SPEED REDUCERS** — 8-page booklet, No. 125, presents 2 new Cleveland vertical speed reducers, particularly suited to such equipment as agitators and mixers, and for use in connection with supplementary low-speed spur-gear drives, without outboard bearings. Cleveland Worm & Gear Co, 3295 E 80th St, Cleveland 4, Ohio.

N27 **MERCURY CLUTCHES**—3 bulletins: No. 216 describes the Mercury clutch in general, listing and illustrating various applications; No. 217 deals with Mercury Automatic clutches applied to gasoline engines; No. 218 covers electric-motor installations. Automatic Steel Products Inc, Canton 6, Ohio.

N28 **SHAFT COUPLINGS** — 8-page folder, No. 50, discusses sphere gear shaft couplings. Diagrams and dimension tables are included. Dykman Mfg Co, 41 Park Row, New York 7, N. Y.

METALS AND ALLOYS

R21 **COPPER ALLOY**—28-page publication, No. B-34, 3rd edition, consists of 2 sections. First part lists Anaconda's most generally used alloys, together with all applicable specifications. Second part lists specifications in numerical order with a brief description of materials covered as to grade, type, temper, anneal, etc. American Brass Co, Waterbury 20, Conn.

R22 **STEEL BOILER TUBES**—Technical bulletin No. TB-331 gives informative data on electric-resistance-welded steel boiler tubes. Tables are furnished on maximum allowable working pressures for different diameters and gauges of tubes for watertube and fire-tube boilers. Babcock & Wilcox Tube Co, Beaver Falls, Pa.

METERS AND INSTRUMENTS, MECHANICAL

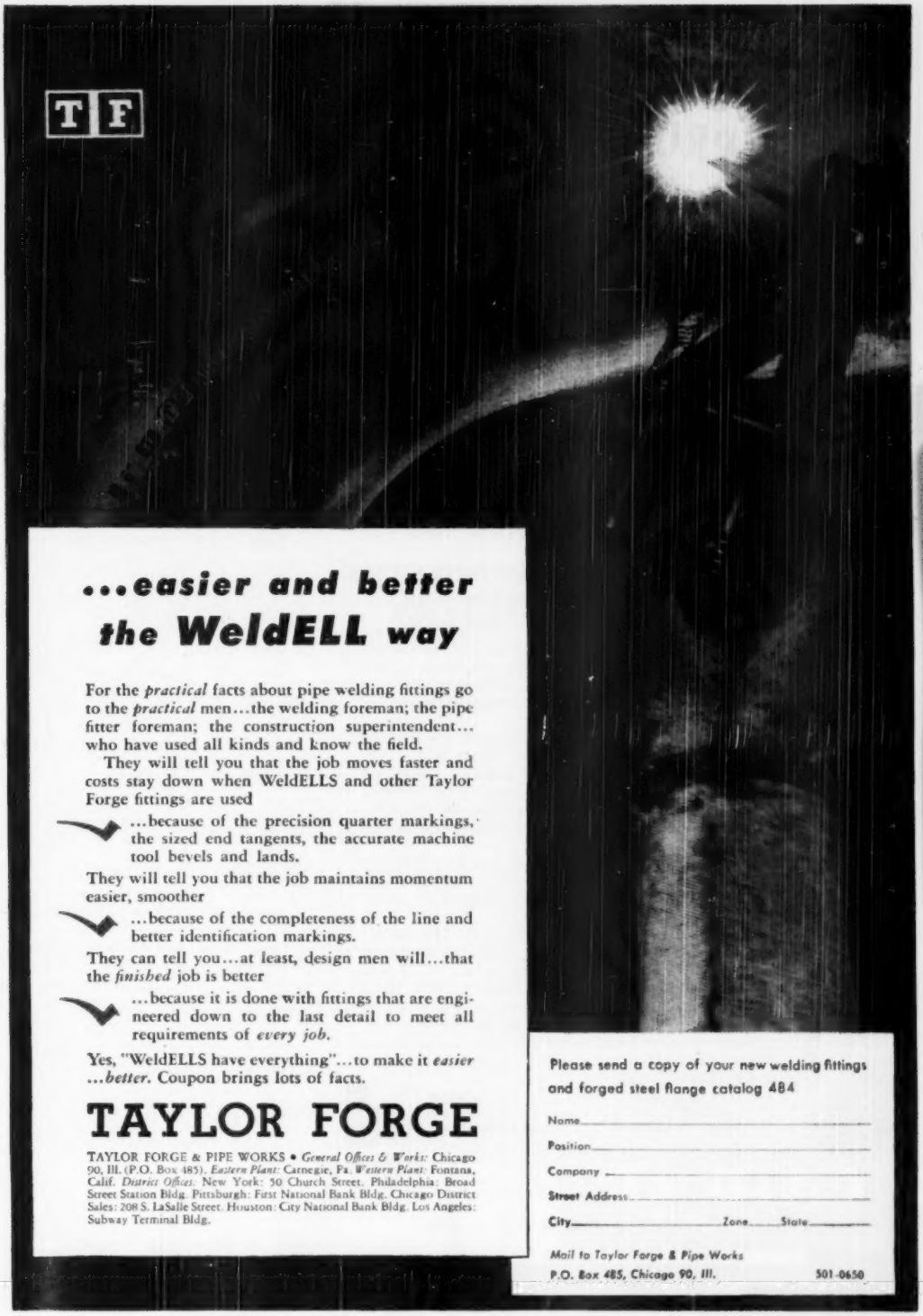
T36 **MANOMETER FLOWMETERS**—8-page catalog, No. 37, illustrates and describes a new line of F&P mercury manometer flowmeters, which require no pressure-tight bearings or stuffing boxes. Fischer & Porter Co, 37 County Line Rd, Hatboro, Pa.

T37 **THERMOMETERS** — 8-page folder, No. 16-C-30, furnishes complete specifications for 80 different commercial thermometers for a wide variety of temperature measurements including refrigeration line, steam, air-duct, diesel engine and geral testing. Retail price list is given. H-B Instrument Co, 2633 Trenton Ave, Philadelphia 25, Pa.

PIPING, FITTINGS, VALVES AND SPECIALTIES

U48 **PACKLESS EXPANSION JOINTS**—24-page booklet features Badger self-equalizing, directed flexing, and nonequalizing expansion joints. General instructions and specifications are included. Badger Mfg. Co, 230-260 Bent St, Cambridge 41, Mass.

U49 **FITTINGS AND FLANGES** — 88-page catalog, No. WF-1950, contains informative data on Grinnell seamless carbon-steel welding fittings and forged steel flanges. Also gives standard schedules with their specifications, list prices and sizes, dimensional tolerances, thread standards and threading practice, etc., for flanges; plus sizes and wall thicknesses of weld-



T F

...easier and better the WeldELL way

For the *practical* facts about pipe welding fittings go to the *practical* men...the welding foreman; the pipe fitter foreman; the construction superintendent... who have used all kinds and know the field.

They will tell you that the job moves faster and costs stay down when WeldELLS and other Taylor Forge fittings are used

...because of the precision quarter markings, the sized end tangents, the accurate machine tool bevels and lands.

They will tell you that the job maintains momentum easier, smoother

...because of the completeness of the line and better identification markings.

They can tell you...at least, design men will...that the *finished* job is better

...because it is done with fittings that are engineered down to the last detail to meet all requirements of *every job.*

Yes, "WeldELLS have everything"...to make it *easier ...better.* Coupon brings lots of facts.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS • *General Offices & Works:* Chicago 90, Ill. (P.O. Box 485). *Eastern Plant:* Carnegie, Pa. *Western Plant:* Fontana, Calif. *District Offices.* New York: 30 Church Street. Philadelphia: Broad Street Station Bldg. Pittsburgh: First National Bank Bldg. Chicago District Sales: 208 S. LaSalle Street. Houston: City National Bank Bldg. Los Angeles: Subway Terminal Bldg.

Please send a copy of your new welding fittings and forged steel flange catalog 484

Name_____

Position_____

Company_____

Street Address_____

City_____ Zone____ State_____

Mail to Taylor Forge & Pipe Works
P.O. Box 485, Chicago 90, Ill. 501-0650

14 OF THE NATION'S 25 LARGEST POWER STATIONS RELY ON CARDOX SYSTEMS*

Leadership naturally attracts leaders! . . . Significant of this is the fact that such a large percentage of the Country's leading power plants and industrial plants depend upon CARDOX systems and equipment for fire protection.

Many years ago, the Cardox Corporation pioneered and made available low-pressure carbon dioxide for fire protection. The systems and equipment using this more effective extinguishing agent were manufactured and installed by CARDOX. New methods, new viewpoints, new techniques — all have been perfected by CARDOX.

In its far-reaching, never-ending research program Cardox has invested millions of dollars in the scientific study of fire hazards and how best to overcome them.

Today Cardox is one of the world's largest producers of carbon dioxide — and the undisputed leader in fire extinguishment and prevention by means of low-pressure storage and mass discharge of this inert, miracle gas.

Savings to Industry have been enormous — not alone in fires prevented, but in minimizing loss of production time, materials and equipment in cases of actual fires.

Have your secretary write for "WHERE THERE'S SMOKE", an interesting booklet about fire hazards, sent gratis to executives.

*Low Pressure Carbon Dioxide Fire Extinguishing Systems covered by Cardox patents issued and pending.

CARDOX CORPORATION

BELL BUILDING • CHICAGO 1, ILLINOIS • Branch Offices in Principal Cities

ing fittings stocked in other metals. Grinnell Co, Inc, Providence 1, R. I.

U50 **CORRUGATED EXPANSION JOINTS**—16-page folder, No. 63, furnishes installation instructions, dimensions, construction and function of Kopperman packless corrugated stainless-steel and copper expansion joints. Joseph Kopperman & Sons, 312-16 New St, Philadelphia 6, Pa.

U51 **STEAM EQUIPMENT**—12-page bulletin, No. G-1307, covers the Yarway line of steam-plant equipment including blowoff valves; water columns and gages; liquid-level indicators and recorders; expansion joints; steam traps; strainers and spray nozzles. Yarnall-Waring Co, Chestnut Hill, Philadelphia 18, Pa.

U52 **RADIATOR VALVES AND TRAPS**—16-page booklet, Section No. 10 & 11, consists of diagrams and dimensions of Marsh radiator valves and traps. Construction and operation details are explained. Marsh Heating Equip Co, Skokie, Ill.

U53 **SAFETY HEADS** — 16-page folder, entitled "BS&B Safety Head Price List," contains sizes, ratings, specifications, and prices of BS&B's safety heads and accessories. Black, Sivalls & Bryson Inc, 720 Delaware, Kansas City 6, Mo.

U54 **REGULATING VALVES** — 12-page bulletin, No. S-22-C, covers the company's complete line of low-pressure regulating valves for controlling gases and liquids in level, temperature or pressure requirements. Swartwout Co, 18511 Euclid Ave, Cleveland 12, Ohio.

U55 **PIPE COUPLINGS**—Catalog No. 50 describes the company's line of high- and low-pressure All-Flex ball-bearing swivel pipe couplings. There are 8 basic styles in sizes from ⅜-12 in. and for pressures from vacuum to 12,000 psi. Gil-Lair Products Inc, 81 Masonic Court, Pasadena, Calif.

U56 **STEAM TRAPS**—2 bulletins are offered. No. 100 discusses special features of Sarco thermostatic steam traps — single bellows for all sizes, no seats to change for different pressures, etc. No. 130 tells about inverted-bucket steam traps. Sarco Co, Inc, Empire State Bldg, N. Y. 1, N. Y.

PUMPS

W38 **PROCESS PUMPS**—4-page folder, No. 1125, discusses the new line of De Laval Type CP process pumps designed for handling hot or cold clear liquids, viscous liquids, corrosive liquids or liquids carrying suspended solids. Vane characteristics and materials of construction can be selected to suit requirements. De Laval Steam Turbine Co, Trenton 2, N. J.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **PUMP-PULSATION PROBLEMS** — 8-page publication, No. 500, treats in detail the pump-pulsation problem. Provides illustrations of typical pumps, flow diagrams of their output, and formulas for determining the sizes of Greer hydro-pneumatic accumulators necessary to obtain optimum dampening of pressure surges produced by 4 commonest piston-type pumps used in hydraulic systems. Greer Hydraulics Inc, 454 18th St, Brooklyn, N. Y.

WATER TREATMENT

X19 **WATER SOFTENER**—12-page booklet, No. WC103, graphically describes design, operation and features of the Graver Reactivator used for water clarification and cold process water treatment. Various accessories are also described. Graver Water Conditioning Co, Dept 103, 216 W 14th St, New York 11, N. Y.

X20 **CIRCULAR COLLECTORS**—16-page pamphlet, No. 4906, gives informative data on 3 different types

If all the Cochrane Hot Process Water Softeners installed in the last 25 years were operating all at once at full capacity they would soften well over Fifteen Million Gallons per Hour. That will give you some idea of the dependable service Cochrane Water Conditioning Equipment has been rendering to steam power plants in every branch of industry in the United States and other countries. It is one reason why the name Cochrane carries the authority it does in all fields of industrial water conditioning. Consult Cochrane engineering service on your next water conditioning job.

COCHRANE CORPORATION • 17th St. & Allegheny Ave. • PHILADELPHIA 32, PA.

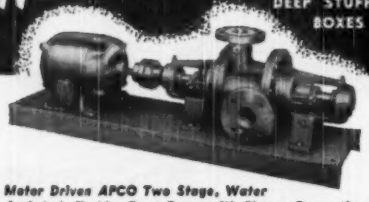
In Canada: Canadian General Electric Company, Ltd., Toronto • In Mexico: Babcock & Wilcox de Mexico, S. A., Mexico City

COCHRANE

HOT PROCESS SOFTENERS • DEAERATING HOT PROCESS SOFTENERS • HOT PROCESS ZEOLITE SOFTENERS

FOR HANDLING HIGH TEMPERATURE AND HIGHLY VOLATILE LIQUIDS

NEW! WATER JACKETED APCO with EXTRA DEEP STUFFING BOXES



Motor Drives APCO Two Stage, Water Jacketed, Turbine-Type Pump with Flange Connections.

SINGLE AND TWO STAGE
•
1750 R.P.M.
•
WIDE RANGE OF SIZES
•
FOR SCREW OR FLANGE CONNECTIONS

Write for BULLETIN 111-WJ

These notable pumps are made available "by request" of many of our engineer friends. Water jacketed APCO pumps were developed specifically for the efficient handling of high temperature and highly volatile liquids. They are designed to compensate for expansion and contraction due to heat. Because Apco's multi-vaned impeller handles vapor or air along with the liquid there can be no vapor lock within the pump. The cool liquid in the water jacket reduces the temperature of any liquid leakage through the extra deep stuffing boxes — thus flashing or vaporizing of the leakage is prevented. May be made of any machinable metal for handling corrosives. Requires but small amount of such special metal — with resultant economy. We invite your consideration of the many features of these fine pumps.

AURORA CENTRIFUGAL PUMPS

A complete line, notable for streamline coordination between impellers and shells, including Single and Two Stage Horizontally Split Case, Side Suction, Vertical, Non Clog, Sump, Mixed Flow, Special Design, etc.

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS

AURORA PUMP COMPANY

50 Loucks Street, AURORA, ILLINOIS

POWER PLANT DESIGN

48 YEARS OF CONTINUOUS EXPERIENCE IN THE DESIGN OF STEAM AND HYDRO GENERATING STATIONS QUALIFIES US TO HELP YOU...

Pioneer Service & Engineering Co.

231 South LaSalle Street • Chicago 4, Illinois

of Carter circular collectors for clarification and sludge collection used in sewage treatment, industrial-waste treatment or water purification. Ralph B Carter Co, Atlantic St, Hackensack, N. J.

OTHER EQUIPMENT

Z58 **VOLTAGE REGULATORS**—16-page bulletin, No. 01B6056C, furnishes engineering details on new design and construction features incorporated in Allis-Chalmers transformer-type AFR ⅝% step feeder voltage regulators. A standard-ratings table is also provided. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

Z59 **PORTABLE COMPRESSOR**—6-page leaflet, No. H-850-B71, features the Worthington Blue Brute 60′ portable compressor, contractor's model. Specifications and dimensions are included as well as illustrations. Worthington Pump & Machy Corp, Harrison, N. J.

Z60 **HEAT-TRANSFER DEVICES**—April issue of *G-R News* outlines many different types of heat-transfer apparatus manufactured by the firm for power plants. Included in the descriptions are boiler feedwater evaporators and heaters, oil and water coolers, heaters for fuel oil and storage tanks, and generator air coolers. Griscom-Russell Co, 285 Madison Ave, New York 17, N. Y.

Z61 **ANNUNCIATORS**—4-page folder explains and illustrates the function and construction of Autocall Type "ANG" annunciators for use in control panels, control desks, etc, in public utilities and industries. Autocall Co, Shelby, Ohio.

Z62 **LABORATORY MATERIAL** — 2 catalogs are offered: No. 94 consists of glass pipe and fittings in ¼- through ¾-in. sizes. No. 95 features precision-bore round, square and capillary tubing for use in high-accuracy barometers and manometers, burettes, and other precision glass apparatus. Fischer & Porter Co, Hatboro, Pa.

Z63 **SYSTEM ALARM**—Single-sheet form, No. A1-4, presents the Superior Unitype audible and visual annunciator. Construction and operation details are given. Superior Appliance Co, 73-39 Central Ave, Glendale, L. I., N. Y.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **METER RETIREMENT**—Bulletin No. GEA-5448 tells about GE's watthour-meter retirement evaluator used in determining the economic point at which to retire older watthour meters. General Electric Co, Schenectady 5, N. Y.

Z64 **DIESEL SETS**—24-page booklet describes the company's facilities and sources for supplying diesel generating sets, motors and electrical equipment. BFM Industries Inc, 2124 Mill Ave, Brooklyn 34, N. Y.

Z65 **DIESEL ENGINES** — 16-page pamphlet, No. 12725, contains information on Caterpillar's latest diesel engines, models D397, D386, D375 and D364. Advantages, specifications and performance charts are included. Caterpillar Tractor Co Peoria 8, Ill.

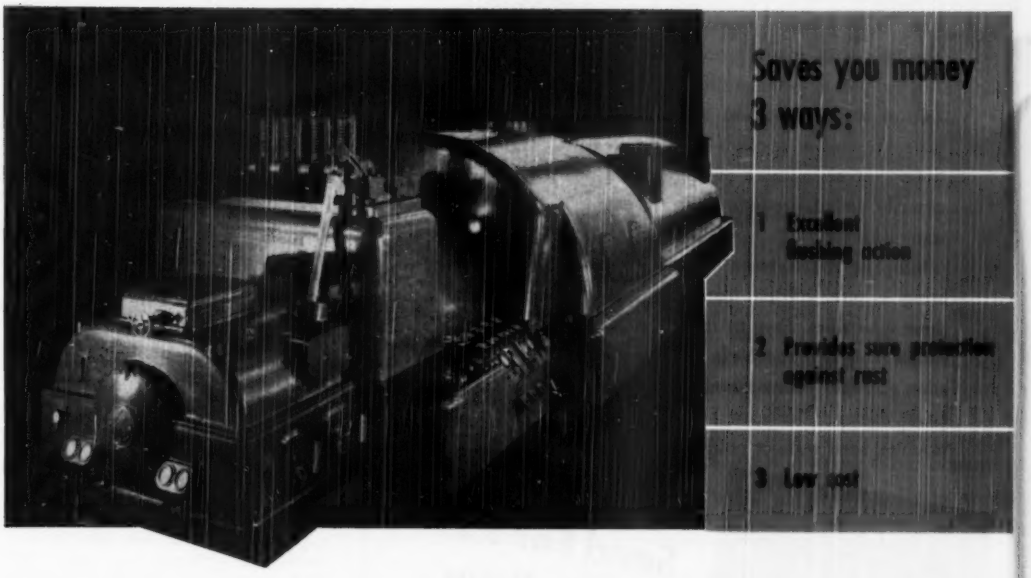
Central Vermont Public Service Corp, Rutland, has ordered a General Electric 5000-kw gas turbine to be installed by July 1951. Total cost, including auxiliaries and building, will reach $1,200,000 for an annual output of about 42,000,000 kwhr. Capability will be 6000 kw. Bunker C will be the fuel, about 500 gal per hr.

Make sure

the lubricating system of that new turbine is clean—

flush with

Gulf Turbine Flushing Oil



The surest way to thoroughly clean the lubricating system of your new turbine is to flush with Gulf Turbine Flushing Oil. It has excellent flushing action—removes grease-type slushing compounds, welding scale, chips, sand and other loose foreign matter. It is very effective in cleaning inaccessible parts of the system.

Gulf Turbine Flushing Oil has been fortified to provide an effective rust preventive film. You can be sure that all oil bathed surfaces in the system are completely protected.

An important advantage of Gulf Turbine Flushing Oil over other types (such as certain solvents) is that the undrained portion in the turbine systems does not impair the lubricating value of the turbine oil. For Gulf Turbine Flushing Oil is itself a satisfactory lubricant.

Only one-third to one-half of a normal turbine oil fill is required for thorough flushing. Thus the expense of flushing your new turbine with low-cost Gulf Turbine Flushing Oil is nominal.

Gulf Turbine Flushing Oil is equally effective for units already in service. In these it helps remove harmful sludge and organic acids—helps flush out deposits which may have collected in the system.

For complete information on this quality product and for recommended procedure for cleaning your turbine, call in a Gulf Lubrication Engineer. Write, wire, or phone today.

GULF OIL CORPORATION • GULF REFINING COMPANY

GULF BUILDING, PITTSBURGH, PA.

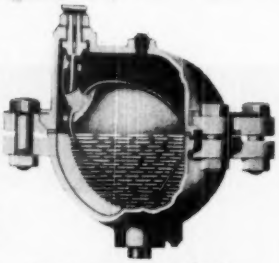
Sales Offices - Warehouses

Located in principal cities and towns throughout Gulf's marketing territory

GULF INDUSTRIAL LUBRICATION

How to get rid of ACCUMULATED AIR IN PIPE LINES . . . *carrying hot or cold water, industrial liquors, sewage and other liquids . . .*

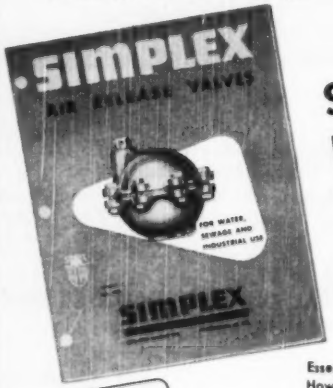
The accumulation of air in water lines under pressure presents the engineer with many problems. Air, lodging at peaks in the line, reduces the effective area of the pipe, creates a friction head, lowers the entire line's pumping capacity, and may result in serious water hammer.



Simplex Air Release Valve

The Simplex Air Valve is easily installed . . . positive in action . . . ample in capacity. Standard valves for pressures up to 250 p.s.i. . . . special valves for pressures up to 800 p.s.i. Thousands have been in successful use for over 30 years.

Simplex Air Release Valves bring a sure, efficient cure for these difficulties. Easy to install, simple in design, positive in operation . . . they vent accumulated air automatically before it can cause damage. To learn how *you* can avoid accumulated-air troubles, send without obligation for our new bulletin.



Send For This Free Bulletin Today!

PARTIAL CONTENTS

Essential Requirements for Air Release Valves
How Simplex Takes Care of Air in Pipes
Methods of Installation
Design and Construction Details

Write to Simplex Valve & Meter Co., Dept. 6, 6780 Upland St., Phil. 42, Pa.

IT'S ACCURATE IT'S SIMPLEX

SIMPLEX

VALVE AND METER COMPANY

POWER NEWS

(Continued from page 140)

with 3,012,000 hp installed. Chief Joseph plant will have twenty-seven 100,000-hp units, or 2,700,000 hp completed. This brings total power to nearly 6,000,000 hp within 50 miles of this river, or equal to that of Niagara Falls if all its water were used. This plant is being built by the U. S. Corps of Engineers, whereas Grand Coulee is constructed by U. S. Bureau of Reclamation.

Canada Aluminum Co Studies Hydro Site

Aluminium Co of Canada will determine this year whether a feasible damsite can be found on the Nechako River in Tweedsmuir Park area of northcentral British Columbia for a 1,500,000-hp hydro development for a proposed $500,000,000 aluminum refinery project.

McNeely Dubose, vice-president of Alcan, in Victoria, B.C. to discuss terms of a water rights' agreement with the provincial government, said Kitimat, near Terrace, is the most favored site for the projected plant.

Drilling and other work necessary to prove up a suitable damsite was halted during the winter, but was resumed early in the year. Last year one damsite proved unsuitable because of the depth of bedrock on one side of the Nechako.

National Bureau of Standards has an extensive project under way—the revision of all the common thermocouple scales to take into account recent changes in electrical units and the International Temperature Scale.

Westinghouse Electric Corp has put on the road a traveling show called Productive Power, to demonstrate how industry can do its work better, faster and cheaper electrically. The show is sponsored by public utilities for industrial customers in 125 cities. First showing was in Akron; it will continue until 1951 when the last show will be given on the Pacific Coast.

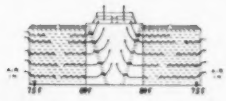
Winnipeg Electric Co Extends Powerhouse

During 1949, the Winnipeg Electric Co generated 4.5% more power than in 1948 and work on its Seven Sisters hydroelectric-plant extension moved ahead rapidly. The tailrace was completed and the earth dykes built to their design levels. Water level in the storage reservoir is being gradually raised.

Near the end of last year, No. 4 unit was completed, which added 37,500 hp to the company's generating capacity. Superstructure of the power house is finished, and so is pouring of concrete for No. 5 unit. This 37,500-hp unit will be ready for service before the end of this year.

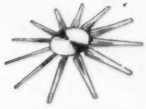
OPEN DISTRIBUTION SYSTEM

Double-Flows always operate at top efficiency because the water distribution system is available. Water flow to each cell is easily regulated . . . cleaning, a matter of minutes.



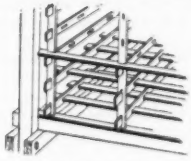
COLDER WATER

Water falling near the louvered side walls is at near wet bulb temperature. Only Double-Flow, with its cross-flow design, can give this extra-cold water.



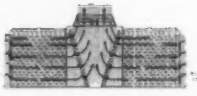
MULTIBLADED FANS

Vibration and "rough operation" caused by air pulsations are prevented by the use of multibladed fans. These large rugged, multibladed fans insure longer tower life.



NAIL-LESS FILLING

No warped, twisted or sagged filling because filling members are free to expand and contract in a definite pattern. This nail-less filling has been field-proven during the past decade.

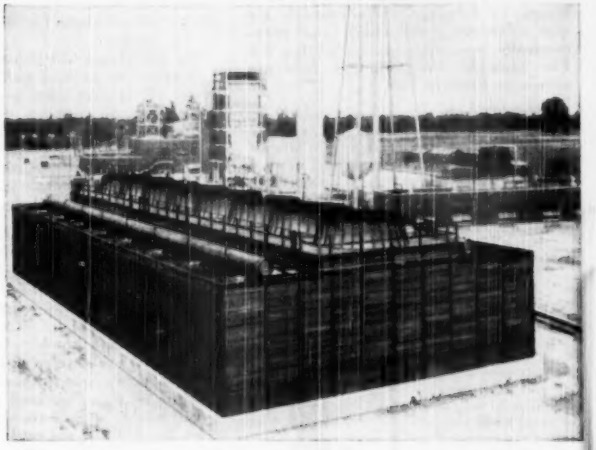


NO AIR CHANNELING

No "dead spots" caused by air streaming from small louvered openings to the fan. Full height louvered walls assure intimate air-water contact in all parts of the cooling chamber.

At No Extra Price

On The Marley Double-Flow



AND, that's not all . . . you also get rugged Marley Geareducers, heart quality redwood lumber, ring connectors, more square feet of drift eliminators, more wetted surface per cubic feet, regulator valves on each cell, bolted compression-system diagonals with full bearing at each end, no nozzle pressure required, less pumping head, walkways, shiplap double wall casing and many other features.

Marley research and development is continually at work bringing out new ideas—setting a higher standard for the cooling tower industry.

Get these important features on your next cooling tower. They are standard on the Marley Double-Flow . . . *at no extra price.*

MAIL THIS COUPON TODAY

The Marley Company, Inc., Kansas City 15, Kansas

☐ Please send me without cost or other obligation Bulletin DF-50. ☐ Have Marley Application Engineer call.

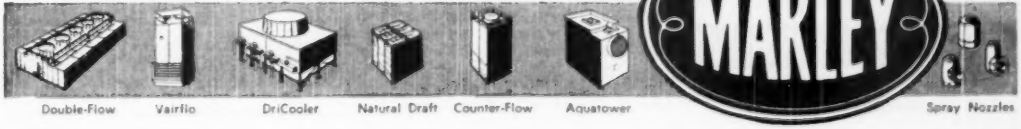
P-6

Name _____ Title _____

Company Name _____

Address _____

City _____ State _____

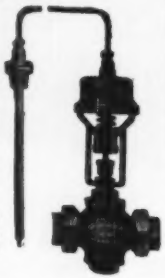


Which ATLAS Temperature Regulator Do You Want?

We offer the self-contained type, illustrated and described in Bulletin 7A. We also offer the hydraulically and pneumatically operated type—Bulletin 6A. For example, the following four are shown in Bulletin 7A:

ATLAS No. 650 is a Balanced Type Double Seat Valve. Spring Adjustment. For temperatures from 70° to 300° F. Bulb is immersed in liquid and control valve installed in steam supply. ½", ¾", and 1" for steam pressures up to 150 lb. 1¼", 1½", 2" and 2½" for steam pressures up to 100 lb. Operates in vertical or horizontal position.

ATLAS No. 651 is a Needle Type Single Seat Valve. Spring Adjustment. For temperatures from 70° to 300° F. Used where tight seating valve is essential such as on small oil heater pump sets, open or closed tanks, sterilizers, glue heaters, etc. ½" and ¾" for steam pressures up to 150 lb. Operates in vertical or horizontal position.



ATLAS No. 655 is a Balanced Type Double Seat Valve. Lever and Weight Adjustment. For temperatures from 70° to 300° F. Lever and weight adjustment of control valve assure high sensitivity. For maintaining temperature of liquids in all kinds of tanks and heaters, ½", ¾", and 1" for steam pressures up to 150 lb. 1¼", 1½", 2", 2½", 3", 4", 5", 6", and 8" for pressures up to 100 lb. Operates in horizontal pipes.

ATLAS No. 660 is a Single Seat Self-Contained Pilot Operated Valve. Spring Adjustment. For temperatures from 70° to 300° F. For use where accurate regulation demands a quick opening and tight closing control valve and where steam pressure is always 25 lb. or more, as for instantaneous heaters and tanks for water, oil, etc. ½", ¾", 1", 1¼", 1½", and 2" for steam pressures up to 300 lb. 2½", 3", and 4" for steam pressures up to 250 lb.

CHECK THESE ATLAS PRODUCTS

Check the items below on which you would like to have complete data and mail to us with your name, firm name and address.

- ☐ Temperature Regulators
- ☐ Damper Regulators
- ☐ Reducing Valves
- ☐ Exhaust Control Systems
- ☐ CAMPBELL Boiler Feed Water Regulators
- ☐ Pump Governors
- ☐ Pressure Regulators
- ☐ Oil Control Cocks
- ☐ Humidity Controllers
- ☐ Thermostats
- ☐ Balanced Valves
- ☐ Control Valves

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

289 South St. Newark 5, N. J.

Represented in Principal Cities

Canada Builds Units for Brazil

An order for two large hydraulic turbines for export to Brazil has been placed by Westinghouse Electric International Co with the Dominion Engineering Works, Montreal, Canada. These vertical-shaft francis units are rated 83,000 hp each, under 266-ft effective head. They are to be installed in the new Paulo Alfonso hydroelectric project of the Cia Hidro Electrica de Sao Francisco.

The powerhouse will be underground in a chamber cut in solid rock. A separate tunnel will conduct water to each turbine. Water from the turbines will discharge through a long tailrace tunnel. This arrangement makes it economical to use a low setting for the powerhouse with respect to tailwater elevation. As a result, turbines are being built for the comparatively high speed of 200 rpm.

Burgess-Manning Co reports that its laboratories find more industries seeking noise-abatement devices because greater output demands and longer machine duty increase the noise problem for management, labor and insurance companies. With loss of hearing from exposure to noise regarded as an occupational disease that is compensable in more than 30 states, interest and study of the subject is sure to grow.

Westinghouse Electric Corp will build the four 140,000-kva 3-phase transformers to be used at the new Johnsville, Tenn. steam plant of the TVA. Transformers will step-up generating-plant voltage from 13,200 to 161,000 v for transmission.

Babcock & Wilcox Co has installed new laboratory equipment at Alliance, Ohio to enable the company to compile accurate data on creep and stress-rupture properties of carbon steel, alloy steel, other metals. Such information has considerable value for manufacturers of steam-generating equipment.

Power Use Jumps In British Columbia

Electric-power consumption in the city of Vancouver and lower mainland of British Columbia has increased 2½ times in 10 years, Thomas Ingledow, chief engineer of the B.C. Electric Co, stated recently. Winter peak load in 1939-40 was 117,000 kw, and in 1949-50 it was 291,000 kw. In the same period output for a single day climbed from 1,780,000 to 4,700,000 kwhr, an increase of 260%. Increased demand is all the more impressive when you realize that a large part of it came after the war.

To meet this unusual load growth the B.C. Electric Co has spent nearly $30,000,000 since V-J Day to enlarge its system's generating capacity, notably in Bridge River plant. There, 130 miles northeast of Vancouver, 186,000 hp have been added in 4 years, making this plant the largest single source of power in Western Canada.

Slash Power Costs!!

WITH

TODD BURNERS

- GAS OR OIL

You'll be amazed how Todd Burners cut your fuel and maintenance costs. Savings up to 10% . . . increased power capacity can be yours with Todd Burners. In replacement of obsolete equipment or in new installations, skilled specialists—backed by 35 years of Todd experience—engineer your job individually to assure you utmost economy in burning of liquid or gaseous fuels.

Oil Burners
Gas Burners
Combination Oil and Gas Burners

COMBUSTION EQUIPMENT DIVISION
TODD SHIPYARDS CORPORATION
81-16 45th Ave., Elmhurst, Queens, N. Y.

See the Classified Telephone Book

NEW YORK • BROOKLYN • ROCHESTER • BUFFALO • HOBOKEN • NEWARK • PHILADELPHIA • HARRISBURG • YORK • PITTSBURGH CHICAGO • RALEIGH • CHARLESTON, S. C. BOSTON • SPRINGFIELD, MASS. • BALTIMORE WASHINGTON • RICHMOND, VA. • ATLANTA BIRMINGHAM • CLEVELAND • DETROIT • GRAND RAPIDS • TAMPA • GALVESTON • SAN ANTONIO DALLAS • HOUSTON • TULSA • MOBILE • NEW ORLEANS • SHREVEPORT • DENVER • SALT LAKE CITY • LOS ANGELES • SAN FRANCISCO SEATTLE • MONTREAL • TORONTO • BARRANQUILLA • BUENOS AIRES • LONDON

FOR

✓ *softening*

dealkalization

deionization

silica-removal

Monobed deionization

A complete line of

AMBERLITE

ion exchange resins

In a pamphlet that belongs under the glass on your desk top we've condensed a part of our knowledge on the use of AMBERLITE IR-120 in water softening. The extremely high capacity of the resin, even when operated at low regeneration levels, is described. The effects of flow rates and water temperatures on headloss and expansion are tabulated. And we've squeezed into 5 tables and 811 words a description of the resin that resists acid, alkali, chlorine, heat, attrition, and waters low in silica.

If you plan to install a new high-capacity softening unit or if you want to replace zeolites of low capacity with a resin of high capacity and efficiency, you owe it to your boilers to write Department **PI-2** for your copy of the pamphlet on AMBERLITE IR-120.

Send for this free folder today

CHEMICALS FOR INDUSTRY

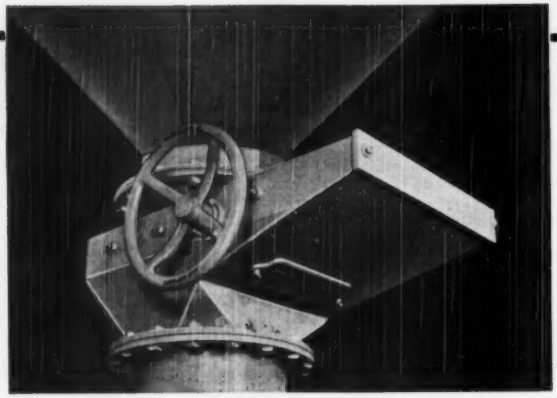
ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square Philadelphia 5, Pa.

The Resinous Products Division was formerly The Resinous Products & Chemical Company

AMBERLITE is a trade-mark, Reg. U. S. Pat. Off., and in principal foreign countries.



S-E-CO. COAL VALVES are equipped with U-shaped gates. This construction assures easy operation of the valves because operating racks, pinions, and supporting rollers are in a space at the side, and, therefore, moisture in the coal does not run over these parts and cause rapid corrosion and subsequent sticking of the valve.

Write for bulletin.

STOCK EQUIPMENT COMPANY
715P Hanna Building ★ Cleveland 15, Ohio

Get this Quick, Reliable
Schweitzer TROUBLE SPOTTER
for DIESEL ENGINES

By Mail
Postpaid
$3.00

SIZE
4¾ x 8¾
inches

Slide Rule Accuracy

This guide prepared by Paul H. Schweitzer, Dr. Eng. Penna. State College in collaboration with Diesel Engine experts enables operators and service men to locate and remedy troubles encountered in Diesel engine operation. Makes trouble spotting an easy semi-automatic process, and points unerringly to the proper remedy, thus saving a great amount of time and expense. The guide is snugly encased in stout plastic jacket.

The Guide is divided into two sections. The first section is entitled **TROUBLE** and it lists the code numbers for various observations, each with the corresponding trouble or troubles.

The second section is entitled **DEFECTS** and it deals with the origin of the various troubles.

The two sections are interlocked through a unique numbering system, which makes the use of the Guide extremely convenient.

The **TROUBLE** section carries code numbers in the left side column. These numerals correspond to those of the Trouble Spotter, attached to this booklet.

The second column lists supplementary observations which help to diagnose the trouble or to select the correct one if one code number allows more than one.

The third column lists the probable troubles corresponding to their code numbers.

Edward M. Power Co., Inc., 602 Granite Bldg., Pittsburgh 22, Pa.

APPOINTMENTS

Diamond Power Specialty Corp, Lancaster, Ohio, has elected William J Fitzburgh executive vice-president. W F Cantieri has become chief engineer.

Gordon S Schumacher succeeds R L Sullivan, resigned, as district manager in Los Angeles for **Hagan Corp** and its subsidiaries, Calgon Inc, Hall Laboratories Inc, and Buromin Co. He will be assisted by Joseph R Shafer.

Elliott Co appoints C Porter Packard sales manager of its Crocker-Wheeler Div, Ampere, N. J. Fred I Biggs is now division engineer for Ridgway Works of the company.

John A Menster has been named assistant manager of sales for Welded Tube Div of **Babcock & Wilcox Tube Co.** He will continue to make his headquarters in Alliance, Ohio.

Armstrong Cork Co announces election of the following officers: C J Backstrand replaces H W Prentis Jr as president. Prentis is now chairman of the board. Kenneth O Bates is re-elected vice-president and designated executive vice-president. M J Warnock becomes vice-president and treasurer. All other officers are re-elected.

R D Moody has been made manager of **Allis-Chalmers'** Los Angeles district succeeding C W Schweers, who has been appointed manager of New England region with headquarters in Boston. James A Longley Jr has replaced Moody as San Francisco manager. In addition, Otho V Tally has been named manager of Midwest region, with headquarters in Chicago, succeeding Benjamin F Bilsland, who is retiring July 1. Baldwin G Witty has succeeded Tally as manager of St. Louis district.

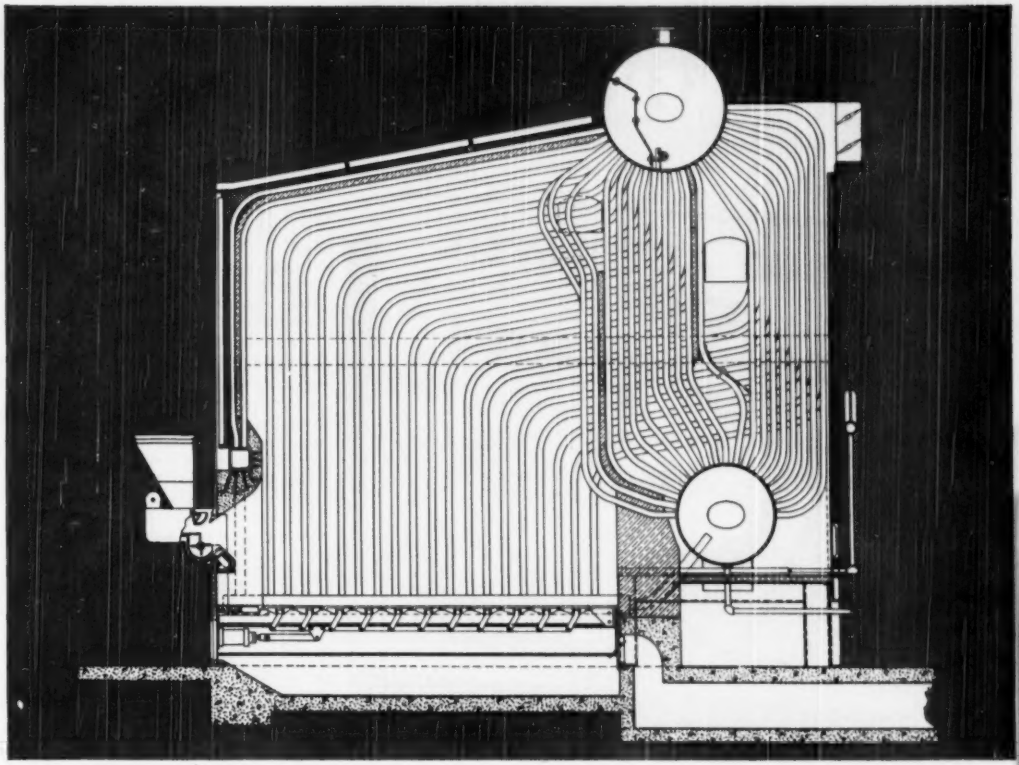
Crane Co announces promotions as follows: H D Gibson replaces W O Brown as branch manager at Richmond, Va. Brown is advanced to manager of plumbing dept, general office, Chicago. G B Batchelor succeeds Gibson as manager, Norfolk, Va., and P J Sineath Jr is now manager, Roanoke, Va.

H G Ebdon and William P E Ainsworth have been elected vice-presidents of **Combustion Engrg-Superheater Inc,** New York.

Cochrane Corp, Philadelphia, has appointed Ervin J Bookout Eastern sales manager.

Harold J Bordelon is promoted to advertising supervisor of **Fluor Corp, Ltd,** Los Angeles, Calif. He succeeds Jack E McKay, who is now sales engineer in the firm's Houston sales office.

General Electric Co reports following personnel changes: P A McTerney becomes administrative assistant to J M Crawford, manager of GE's large motor and generator divs. S V Travis will assume McTerney's former duties as manager of sales, with L



THE *V-C* 2-DRUM *High Capacity • Small Space*

COMBINING BOILER • WATER WALL FURNACE • INSULATED STEEL CASING

ERIE CITY concentrates high capacity into small space. The V-C Steam Generator has complete water cooling of top, sides and front, integral with a 2-drum boiler.

GAS travel is symmetrical about the center line of the unit.

WATER circulation is ring flow.

ONE or two internal steam separators, as required, assure clean, dry steam.

THE entire unit is supported from bottom members, thus allowing free expansion upward of the entire unit. All exterior walls consist of insulated steel panels, independently suspended, a construction similar to that of our largest central station steam generators.

ANY tube can be replaced without disturbing any other tube.

THE above illustration shows an Erie City Spreader Stoker fired V-C unit, utilizing a water cooled plastic arch, molded around the front header.

THE Erie City V-C Steam Generator is available in a wide range of capacities for varying space limitations and for all firing methods. Write for bulletin 37.

COMPLETE STEAM POWER PLANT EQUIPMENT

ERIE CITY

Complete Steam Generators • Type C 3-Drum Boilers • Type VL 2-Drum Boilers • The "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • Coal Pulverizers • Underfeed and Spreader Stokers • Welded Pressure Vessels for the Process Industries.

ERIE CITY IRON WORKS • ERIE, PA. • *Since 1840*

It tells how the Chicago Automatic Stoker meets the over-all Firing Requirements for a Wide Range of Steam Demands

Other pertinent information and typical layouts are included in this new spreader stoker bulletin now available for distribution. The Chicago Automatic with its many operating advantages and features of design is firing numerous types of boilers with variable load requirements for important commercial and industrial concerns.

For your copy of the new Chicago Stoker Bulletin, Publication No. 85, address Dept. D-5, The Standard Stoker Company, Inc. 370 Lexington Avenue, New York 17, N. Y.

THE STANDARD STOKER CO • INC •

Standard Stoker

NEW YORK • CHICAGO • ERIE • MONTREAL

H Matthes as assistant manager, for above divisions. C E Burke is named manager of sales, specialty transformer and ballast divs, Fort Wayne, Ind.

Ralph Pat Kelley & Associates, 1521 S W 11th Terrace, Miami, will represent **Industrial Sound Control Inc** in Florida.

Kaylo Div, Owens-Illinois Glass Co transfers its Dallas branch to Houston with J K Dixon as sales engineer. Dixon's office will be at 2201 Neils-Esperson Bldg, and his territory will include the Gulf Coast east to Florida, entire state of Louisiana, and Texas as far north as Waco and San Angelo. Also, Atlanta branch is re-established, with Carl Ramien, sales engineer, in charge. E E Drake is assigned to the new office in Oklahoma City.

Warren L Smith has been elected president of **M W Kellogg Co,** succeeding Harold R Austin, who retired. Bennett Archambault has been named vice-president and general manager, a newly created post. G Frank Bayes, Ronald B Smith and Zary A Toula have also been made vice-presidents. Incumbent vice-presidents, Dr William E Hanford, Alexander Kidd, and Frank Liebrecht have been re-elected. Daniel J Olsen has become treasurer and comptroller, and Edwin L Gidley, secretary.

Graver Water Conditioning Co announces appointment of Tom Charbonneau as Florida representative. His headquarters are at 305 W Colonial Drive, Orlando, Fla. Bird-Archer Co, Ltd, McGill Bldg, Montreal, will be the firm's Canadian representative.

Earl V Harlow is now engineering assistant to Walter F Perkins, vice-president and general manager of Metal Products Div, **Koppers Co, Inc,** in Baltimore, Md.

Nordberg Mfg Co assigns Dice Cowger to St. Louis office as district manager of its diesel engine dept.

Cecil H Gay, works manager of **Babcock & Wilcox Co's** Barberton, Ohio plant, has been elected a vice-president.

Boston Woven Hose & Rubber Co of Pittsburgh, 123-125 Water St, Pittsburgh, Pa., is chosen by **Pennsylvania Flexible Metallic Tubing Co** as its distributor in Pittsburgh.

J M Floyd has become executive vice-president of **A O Smith Corp,** Milwaukee, Wis.

Republic Rubber Div, Lee Rubber & Tire Corp, Youngstown, Ohio, names Howard H Sprinkle assistant sales manager. John G Hubbard assumes duties of field engineer. Hubbard will represent Republic in South Carolina and northern part of Georgia with headquarters in Columbia, S. C.

Tube Turns of Canada, Ltd, appoints Arthur H Brodie district manager. His headquarters will be at the firm's plant in Chatham, Ontario.

New York offices of **Raybestos-Manhattan Inc** are now at 500 Fifth Ave, New York City. These offices also include the

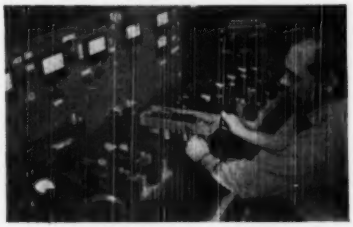
Six Reasons Why HAYS = O_2 LEADERSHIP!

1

HAYS WAS ONE OF THE FIRST TO RECOGNIZE AND APPLY THE PARAMAGNETIC PRINCIPLE

As early as 1909, Joseph Hays recognized the need for an Oxygen Recorder. Thirty years and five oxygen analyzing instruments later, Hays research engineers had a principle worth complete exploitation—the paramagnetic qualities of oxygen. Then followed . . .

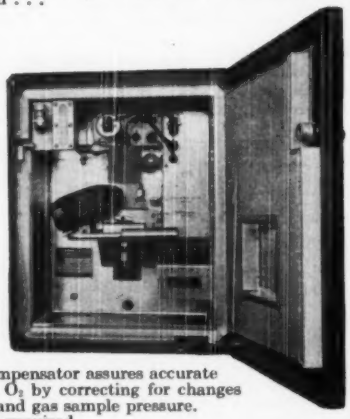
2



MONTHS OF CONTINUOUS LABORATORY RESEARCH

Once it had been established that magnetically induced thermal resistance changes accurately mirrored O_2 content changes in a gas sample, millionfold amplification was required. Existing amplifiers proved inadequate, so Hays designed their own. When their Analyzer and Recorder were completed, it became clear that Hays had an instrument with unequalled . . .

3



PRACTICAL DESIGN FEATURES

Positive, instant zero check through free swinging magnet. High sensitivity, rapid response to O_2 changes—rugged construction.

Patented compensator assures accurate readings in % O_2 by correcting for changes in barometric and gas sample pressure.

No chemical required . . .
No combustion . . . complete safety
No gaseous or liquid fuels added to gas sample
Provision for 4 records on one chart

BULLETIN 49-829 free for the asking, describes the principle and operation of this instrument . . . write for it!

4

PAINSTAKING, PRECISION FABRICATION

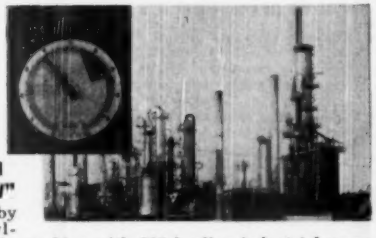
High accuracy and sensitivity require close tolerances—production problems arose. Hays solved these problems by investing large sums in new machines, by building their own equipment not available elsewhere, by using their 40 years of instrument manufacturing "know-how." When finished, the new O_2 Recorders were subjected to . . .

5

FOUR YEARS OF INTENSIVE FIELD RESEARCH

Test installations were made in the oil, steel and glass industries; power plants, and laboratories. Instrument performance was noted under varying conditions, findings were then translated into product improvements. New compensations, calibrating techniques and adjustments were developed, giving Hays a wealth of . . .

6



APPLICATION "KNOW-HOW"

You benefit by Hays knowledge gained in working with 200 leading industrial users . . . experience in applying the Magno-Thermo O_2 Recorder to Catalyst regenerators, process heaters, heat treating furnaces, open hearths, government laboratories and similar operations.

The Hays CORPORATION
MICHIGAN CITY, INDIANA, U.S.A.

THE HAYS CORPORATION
Michigan City 3, Indiana

Please send me Bulletin 49-829 which describes the Hays Oxygen Recorder and Analyzer

Name_____
Company_____
Address_____
City_____ Zone____ State_____

Remove Oil...

FROM BOILER AND PROCESS WATERS THIS NEW LOW-COST WAY!

What it is —

Filtration with Sorbo-Cel is a simple, low-cost method of removing emulsified oil from water. In plants using steam generating equipment, it is proving an especially effective and economical means of obtaining oil-free condensate for boiler feed. It also provides a practical solution to other oil-contaminated water problems, such as the water used in pumps, condensers, cooling systems, moving driers, etc.

How it works —

The method is similar to that used in other conventional industrial filtration operations. A small amount of Sorbo-Cel (a specially processed diatomaceous silica powder), is added to the water to be filtered. This is then pumped through a pressure filter where the oil globules are adsorbed by the specially treated Sorbo-Cel particles. Both are retained on the filter screen, the filtered water alone passing through. Any type of pressure filter having a metal screen and capable of operation at a pressure differential of 30 psi or more may be used.

What its advantages are —

Sorbo-Cel filtration is fast, economical and efficient. It assures virtually complete removal of oil, as well as suspended solids such as rust, scale, clay, etc. Large volumes of water are filtered in a relatively short time, yet total costs (including both material and operation) range from only 1¢ to 3¢ per 1000 gallons of water filtered.

For further information about Sorbo-Cel filtration use the coupon below.

JM

Johns-Manville

SORBO-CEL

Johns-Manville
Box 290, New York 16, N. Y.

Send me free bulletin giving advantages of Sorbo-Cel filtration.

Name_____

Company_____

Address_____

City_____ State_____

New York and New England district office of Manhattan Rubber Div. Department of marketing and merchandising is now at the corporation's executive headquarters, 61 Willett St, Passaic, N. J.

Walther H Feldmann has resigned as president of Electric Machinery Mfg Co, Minneapolis, subsidiary of **Worthington Pump & Machy Corp** and has been named vice-president in charge of sales for Worthington. Also, John J Summersby has become vice-president in charge of purchases; Frederic W Thomas, general manager of purchases; and Carleton Reynell, general representative, sales and purchasing depts. Feldmann has been succeeded by Richard H Olson. C F Harwood and Frank D Shumate have retired.

Trumbull Electric Co announces that its marketing department is now operating on a regional basis. Richard C Lipps is regional manager in the East responsible for field sales districts and sales engineering functions from Maine to Georgia. Allan A Watson becomes Central regional manager handling the Middle West and South, extending from western Pennsylvania to Colorado and as far north as Canada. California region, which includes all of California and Arizona and part of Nevada, will be under direction of J Warren Barry. Willis I Downie is manager of Northwest region covering all of Washington, Oregon, Idaho and parts of Nevada, Colorado, and Montana.

Winsmith-Buffalo, Marine Trust Bldg, Buffalo, N. Y., is chosen to represent **Winfield H Smith Corp** in the territory including all of New York State outside metropolitan New York City, as well as Erie, Crawford, Warren and McKean counties in Pennsylvania. Winsmith-Buffalo is a new company under management and proprietorship of L D Ayelotte, former sales manager of Winfield Smith.

Strong, Carlisle & Hammond Co has appointed the following as its distributors: Georgia Hardware & Supply Co, 307 N Washington St, Albany, Ga.; Woodbury & Co, 133 SW Second Ave. Portland, Ore.; Parker Helms & Langston Co, Brunswick, Ga.; Gondas Corp, 2149 N Miami Ave, Miami, Fla.; Industrial Equip & Supplies, 3030 N W 8th Ave, Miami, Fla.; Wilmington Iron Works, Wilmington, N. C.; Mott Brothers Co, 907 S Main St, Rockford, Ill.; M P Wilkins Supply Co, 3 N St. Clair St, Toledo, Ohio; Charles Manoog Inc, 9 Piedmont St, Worcester, Mass.

Frank Purnell has been elected chairman of the board of directors of **Youngstown Sheet & Tube Co**, Youngstown, Ohio. J L Mauthe has been made president and Alfred S Glossbrenner vice-president in charge of operations of the company.

Air Reduction Sales Co selects Wright Welding Supply, 1207 Cherry St, Des Moines, Iowa, as dealer of Airco products to service Carrol, Greene, Boone, Marion and Warren counties in Iowa.

Edwin S Pillsbury has relinquished his duties as president of **Century Electric**

JERGUSON
Explosion-Proof
GAGE ILLUMINATORS

Give Even, No-Glare Low Cost Lighting Greater Safety Of Operation Faster, Easier Gage Reading

JERGUSON Explosion-Proof Gage Illuminators give you the best, lowest cost, most efficient gage lighting.

Utilizing the principle of solid wedge lighting, Jerguson Illuminators give clear, *even* lighting, without bright spots. Light flows through the plastic wedge and is reflected evenly through the back of the gage glass to give quick, easy, accurate reading. You get better illumination at lower cost because only one small lamp is required. Savings in electricity soon pay for the illuminator.

Jerguson Illuminators have aluminum explosion-proof housing for the wiring and heat resisting glass explosion-proof housing for the lamp. You get maximum safety, more efficient lighting with Jerguson. Made for all sizes of transparent gages. It will pay you to investigate.

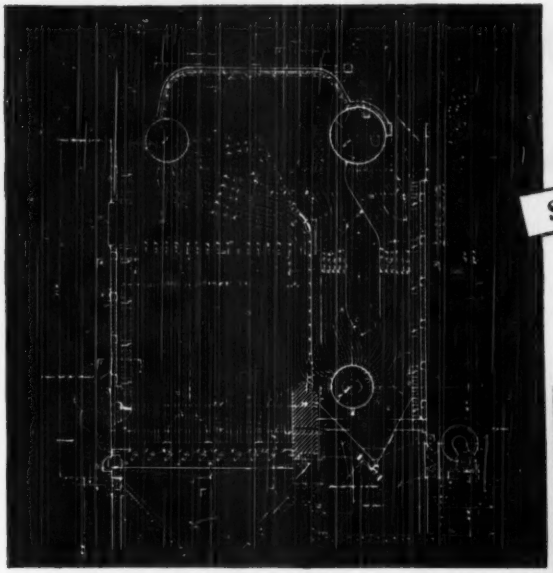
Illustration shows single and double Jerguson Illuminators on a 3-section gage. Write today for full information. Ask also for Data Units on Jerguson Gages and Valves to fit your needs.

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY
100 Fellsway, Somerville 45, Mass.
Representatives in Major Cities
Phone Listed Under JERGUSON

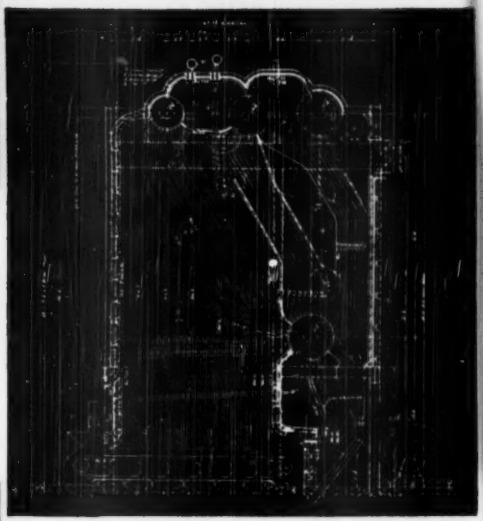
Quick Steaming at all Ratings!



Carry high overloads with high efficiency

SPECIFY **Vogt**

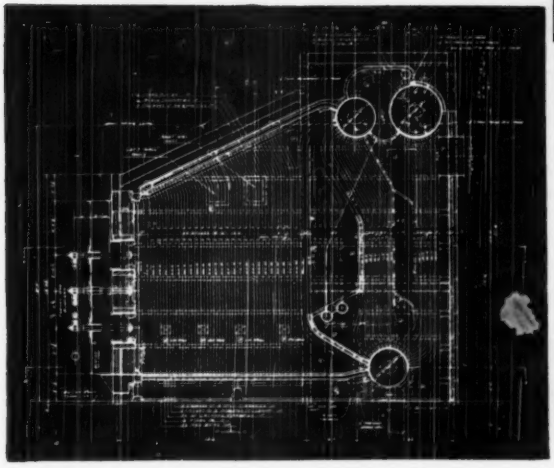
STEAM GENERATING UNITS



CLASS VL — Two 27,500 pounds per hour units, installed at Brown-Forman Distillers Corporation, Louisville, Ky. Features large furnace volume in limited space, with high ratio of radiant heating surface.

CLASS LE — Mt. Carmel Public Utility, Mt. Carmel, Illinois, is served by this 60,000 pounds per hour unit. Generous steam liberating surfaces and steam space permit wide fluctuations in load.

CLASS VR — 70,000 pounds per hour steam generator at Humble Oil and Refining Company, Johnsue, Texas. An efficient, high-duty unit with water cooled furnace, using refinery gas fuel.



Vogt builds a complete line of bent tube steam generators, designed to burn solid, liquid, or gaseous fuels to meet specific operating conditions. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Bulletins with general information and showing typical installations are available upon request.

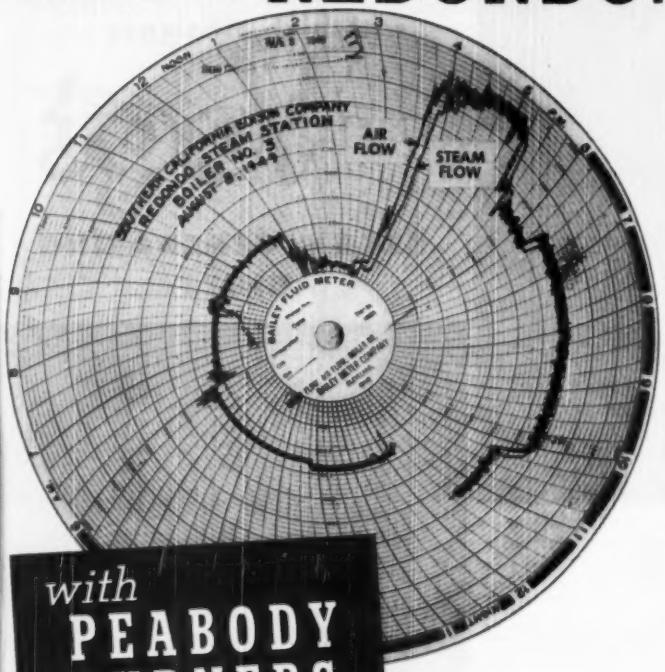
HENRY VOGT MACHINE CO.

LOUISVILLE 10, KENTUCKY

BRANCH OFFICES:
NEW YORK, PHILADELPHIA, CLEVELAND
CHICAGO, ST. LOUIS, DALLAS

20 TO 1

RANGE AT REDONDO!



with **PEABODY BURNERS** *first*

choice of America's leading utilities...

The Redondo Steam Station, like all the other plants of the Southern California Edison Company, is known for its modern engineering and efficient operation. The management of this leading public utility insists upon efficient combustion and steam generation — and they use PEABODY BURNERS to get results! The 42 burners in the Redondo Steam Station generate 3,080,000 lbs. of steam per hour and they are only a part of the 387 PEABODY BURNERS used by Southern California Edison Company in their system to generate over 8,000,000 pounds of steam per hour. For full details on PEABODY BURNERS *write for Bulletins 803 and 903.*

519

OFFICES IN PRINCIPAL CITIES

PEABODY ENGINEERING CORPORATION
580 FIFTH AVENUE · NEW YORK 19, N. Y.
Manufacturers of all types of combustion equipment, direct-fired air heaters, gas scrubbers, coolers, and absorbers

PEABODY LIMITED · LONDON, S.W. 15, ENGLAND

Co, St. Louis, Mo., to his son, Fred H Pillsbury. The elder Pillsbury will continue as chairman of the board of directors.

Marshall E Cusic is promoted to district sales engineer for **Chain Belt Co.** His headquarters are at Pittsburgh district office, 1101 Grant Bldg.

Bituminous Coal Research Inc reports new mailing address for its Pittsburgh office—2609 First National Bank Bldg, Pittsburgh 22, Pa.

Burlington Instrument Co announces that White Sales Co, 10 High St, Boston, Mass., will represent it in the New England territory.

Roy C Ingersoll succeeds C S Davis as president of **Borg-Warner Corp,** Chicago. Davis is elected chairman of the board. G A Shallberg becomes chairman of executive committee. A P Emmert, president of the firm's Warner Gear Div, is now also a vice-president of Borg-Warner. Ingersoll, in addition to his duties as president, will assume duties formerly assigned to the office of executive vice-president.

Eriez Mfg Co, Erie, Pa., appoints Arlo Israelson as chief engineer to replace W W Mojden, now with Mills-Winfield Co, Eriez sales office in Chicago. Dick Dietrich, 1355 Market St, San Francisco, will be exclusive West Coast sales agent for the company's permanent magnetic separators.

L J Richards has been named director of engineering for **Dow Chemical Co,** Midland, Mich. E R MacLaughlin has been advanced to chief engineer of Midland division's engineering dept.

Enterprise Engine & Foundry Co, San Francisco, elects Paul I Birchard vice-president and general manager.

David T Morgenthaler has been made sales manager of **Delavan Mfg Co,** Des Moines, Iowa.

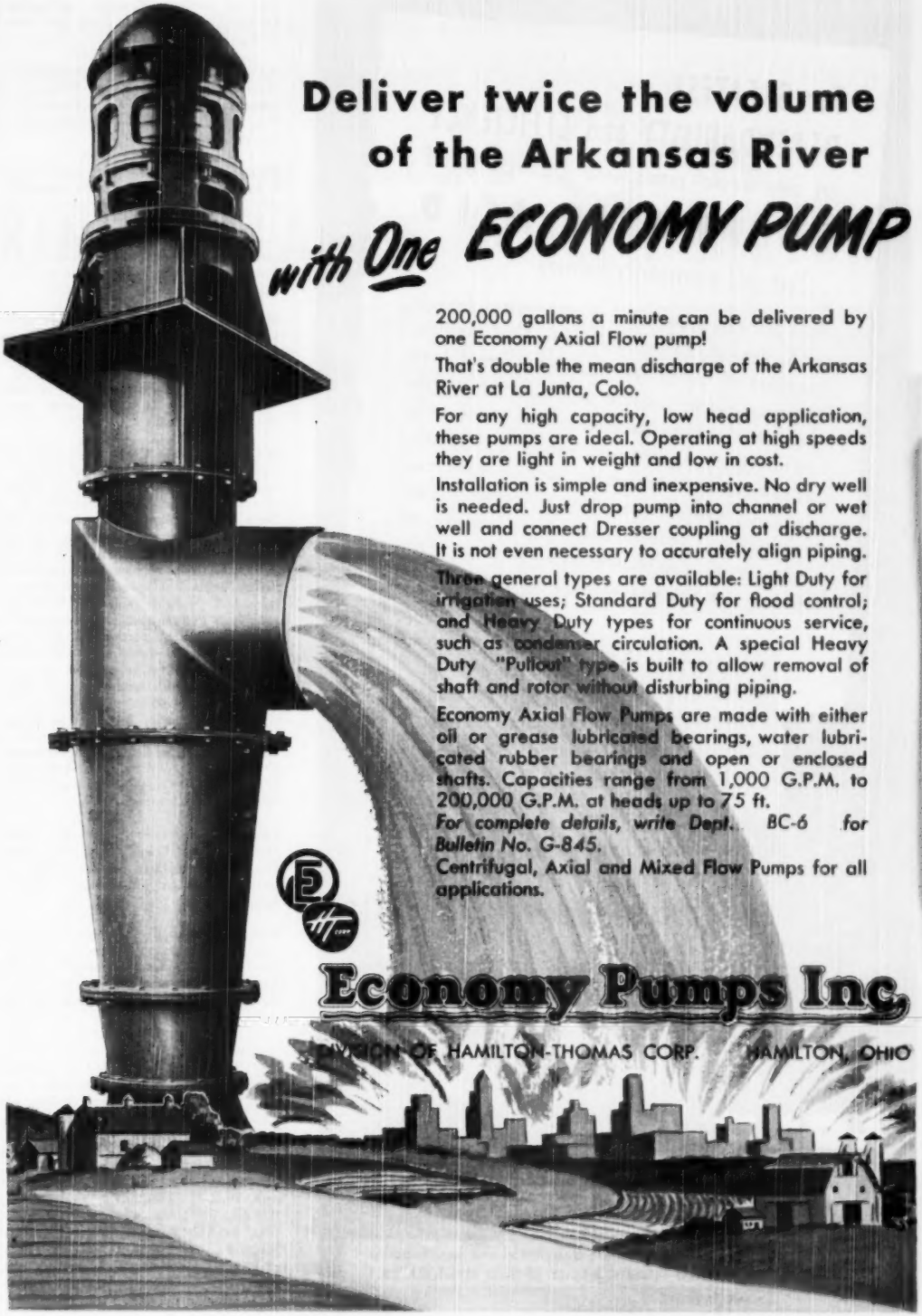
Electric Products Co selects Vincent J Brown Co. with offices in Buffalo and Syracuse, to act as its district representative for New York State with exception of metropolitan New York City.

O O Lewis has been elected vice-president in charge of sales, and F J Heaslip, vice-president in charge of purchases and traffic of **Fairbanks, Morse & Co,** Chicago.

Gould Storage Battery Corp, Trenton, N. J., promotes K A Vaughan to manager of sales engineering. F A Miller is now Northeast regional manager. Mal Janis succeeds Miller as New York district manager. The company's Chicago offices are moved to new quarters at 100 E Ohio St.

Link-Belt Speeder Corp announces election of Columbus Basile as vice-president for operations, with headquarters at Cedar Rapids, Iowa.

Electric Sales Co, 407 Broadway, Kansas City, Mo., has been chosen sales representative for **General Switch Corp** in terri-



Deliver twice the volume of the Arkansas River

with One ECONOMY PUMP

200,000 gallons a minute can be delivered by one Economy Axial Flow pump!

That's double the mean discharge of the Arkansas River at La Junta, Colo.

For any high capacity, low head application, these pumps are ideal. Operating at high speeds they are light in weight and low in cost.

Installation is simple and inexpensive. No dry well is needed. Just drop pump into channel or wet well and connect Dresser coupling at discharge. It is not even necessary to accurately align piping.

Three general types are available: Light Duty for irrigation uses; Standard Duty for flood control; and Heavy Duty types for continuous service, such as condenser circulation. A special Heavy Duty "Pullout" type is built to allow removal of shaft and rotor without disturbing piping.

Economy Axial Flow Pumps are made with either oil or grease lubricated bearings, water lubricated rubber bearings and open or enclosed shafts. Capacities range from 1,000 G.P.M. to 200,000 G.P.M. at heads up to 75 ft.

For complete details, write Dept. BC-6 *for Bulletin No. G-845.*

Centrifugal, Axial and Mixed Flow Pumps for all applications.

Economy Pumps Inc.

DIVISION OF HAMILTON-THOMAS CORP. HAMILTON, OHIO

For GREATEST
DEPENDABILITY and EFFICIENCY
in metered pressure pumping of
SULPHURIC ACID
...at all concentrations

Here is the equipment which will handle sulphuric acid, in all concentrations, performing the dual function of taking the acid from atmosphere pressure to line pressure, and metering or proportioning its flow. Because the Pulsafeeder has no stuffing box—but uses instead an hydraulically-balanced diaphragm seal, it eliminates leakage, prevents corrosion of pump or contamination of product, avoids loss of prime—all at lowest possible maintenance. Hundreds of satisfactory installations to back up these claims!

- NO STUFFING BOX OR RUNNING SEAL
- HYDRAULICALLY-BALANCED DIAPHRAGM SEAL
- POSITIVE DISPLACEMENT PISTON MEASUREMENT
- FLOW RATE ADJUSTABLE WHILE IN OPERATION
- OIL-BATH LUBRICATION OF ALL MOVING PARTS
- UNITS AVAILABLE FOR MANUAL OR AUTOMATIC CONTROL

Lapp
PULSAFEEDER
PISTON-DIAPHRAGM CHEMICAL PROPORTIONING PUMP

WRITE for Bulletin 262 with complete description and specifications.
LAPP INSULATOR CO., INC., PROCESS EQUIPMENT DIVISION, 277 MAPLE STREET, LE ROY, N. Y.

tory of western Missouri, northeastern Oklahoma, southwestern Iowa, and states of Kansas and Nebraska.

F C Shafer has been elected president and chairman of the board of directors of **Imperial Brass Mfg Co,** Chicago. C H Benson and J T Greenlee have been named vice-presidents.

Hungerford & Terry Inc appoints Lyle B Porter, Rockford, Ill., as its representative in northern Illinois and eastern Iowa.

George H Deike Jr, chief engineer and secretary of **Mine Safety Appliances Co,** Pittsburgh, is now a director of the company.

Metal & Thermit Corp has moved its general offices in New York City to new quarters at 100 E 42nd St.

Promotion of J M Hoskinson to sales engineer of **Geo D Roper Corp,** Pump Div, is announced.

Wagner Electric Corp, St. Louis, Mo., reports retirement of A H Timmerman as vice-president and director. G A Waters succeeds Timmerman as director. P B Postlethwaite becomes chairman of the board after retiring as president. He will continue as chairman of executive committee. J H Devor is now president. H N Felton becomes vice-president in charge of sales. L W McBride replaces A K Bahret, retired, as assistant secretary-treasurer. In addition, southern portion of sales territory served by St. Louis electrical division branch of the firm is now set up as a separate unit, with headquarters in Memphis and a sales office in New Orleans. A C Allen remains at Memphis as branch manager. The remaining territory, with a main branch in St. Louis and a sub-branch in Indianapolis, will be under direction of J J Scheid, who succeeds Felton as manager of St. Louis branch.

Paul Garret has been transferred to home office of **York Corp,** York, Pa. Frank Fairfield has replaced him as commercial service supervisor of Southwest district, Houston, Texas.

Fred F Sampson Jr is promoted to manager of electrical sales, Textile Products Div, **Owens-Corning Fiberglas Corp,** New York City. Richard J Lasko is now manager of newly created apparatus insulation sales section.

Max F Balcom has been elected to succeed the late Walter E Poor as chairman of the board of **Sylvania Electric Products Inc,** Boston, and Frank A Poor has become vice-chairman.

Refrigeration Equip Manufacturers Assn elects following officers: *President*—R H Israel, sales manager, refrigeration dept, Virginia Smelting Co, West Norfolk, Va.; *vice-president*—W A Siegfried, president, Superior Valve & Fittings Co, Pittsburgh, Pa.; *treasurer*—W J Stelpflug, vice-president, Hussman Refrigeration, St. Louis, Mo.; *secretary*—John E Dube, president, Alco Valve Co, St. Louis, Mo. These

Initial adjustment by experienced combustion engineers assures proper weighting of all factors

when you install HAGAN

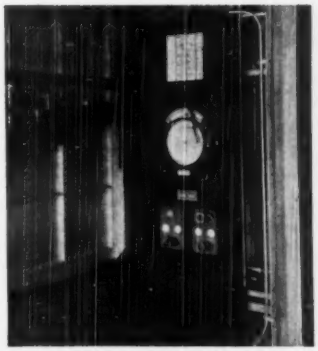
RING BALANCE BOILER METERS

The relationship between the steam flow and air flow records on your boiler meter should be a reliable check on the operation of your automatic combustion control system and a dependable guide for manual control.

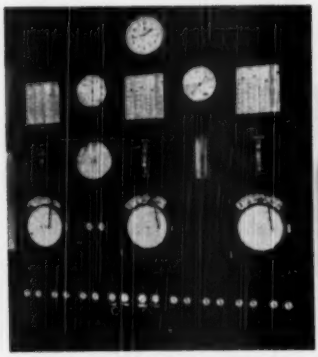
To be sure of a true record of this relationship, you need a sensitive, flexible meter *accurately adjusted so that you may take into account every factor of operation which is affected by excess air.*

That is what you get with the Hagan Ring Balance Boiler Meter. The design and construction of the meter make it inherently sensitive and accurate over a very wide range. Experienced Hagan combustion engineers — men thoroughly familiar with boilers and control systems as well as meters — make the precise initial adjustments essential for continued satisfactory service.

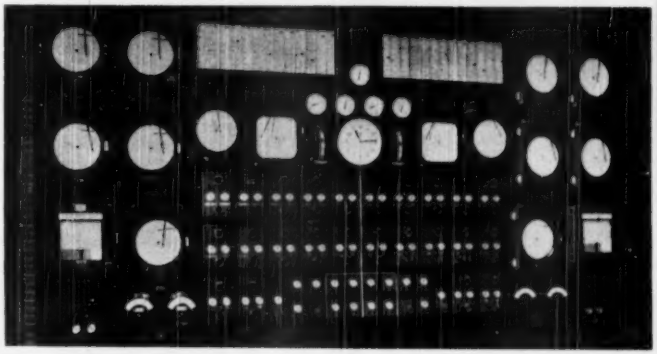
For full information about these and other Hagan Ring Balance Flow Meters, fill out the coupon below or write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.



Hagan Boiler Meter of the recording, and indicating type at Crown Paper Board Co. A third pen records stack temperature. Integrator continuously totalizes steam flow.



Indicating, recording and integrating Hagan Ring Balance Boiler Meters at Artloom Carpet Company. These meters also record stack temperature.



At Alan Wood Steel Company, Hagan Ring Balance Meters are used to measure and record flow of blast furnace gas, coke oven gas and steam, also boiler water level. These meters are recording only.

HAGAN HALL BUROMIN CALGON

HAGAN CORPORATION

RING BALANCE FLOW AND PRESSURE INSTRUMENTS
THRUSTORQ FORCE MEASURING DEVICES
BOILER COMBUSTION CONTROL SYSTEMS
METALLURGICAL FURNACE CONTROL SYSTEMS

Hagan Corporation
Ring Balance Meter Division
Hagan Building, Pittsburgh 30, Pa.

Please send me Hagan Bulletin 2M50.

Name_____

Position_____

Company_____

Street and Number_____

City_____ Zone_____ State_____

PA

Wing Turbine Driven Blowers
Type K
The granddaddy of all Turbine Blowers. Standard since 1903. For forced draft by breaking into boiler wall settings at side, rear or front. Capacities up to 50,000 CFM and static to 15 in. Mere turn of steam valve, manually or automatically, varies the speed and capacity. Oil-free exhaust steam permits economical utilization in feed water, process and heating systems.
Wing Turbine Driven Blowers
Type R
Easily installed on burner fronts or boiler settings, providing precise draft control, manually or automatically, eliminating duct work and large space requirements. Particularly adaptable for plants where oil-free exhaust steam is available. Negligible operating cost, as most of heat from steam is recovered.
Wing Motor Driven Blowers
Type DM3 Single Stage (Shown)
Type CDM 2 Stage
For oil or gas burners, stokers, pulverized fuel and hand-fired boilers. Vertical or horizontal mountings on floor or on wind boxes or air heaters. For statics up to 10 in., volumes up to 50,000 CFM. Manual or automatic capacity variation. Falling horsepower characteristics with dampering. Static efficiencies up to 80%.
Wing
AXIAL FLOW
BLOWERS
L. J. Wing Mfg. Co.

new officers with K B Thorndike, retiring president, become the eexcutive committee of REMA for the fiscal year as of May 1.

National Electric Products Corp, Pittsburgh, Pa., has purchased I A Bennett & Co, Chicago, exclusive sales agent in 15 Midwestern states for National products. R C Bennett Jr, former general manager of the Bennett firm has succeeded Harold J Newton, recently retired as vice-president and sales manager of National Electric. Earl M Nelson, sales manager for Bennett has become National's Midwest district manager.

OBITUARIES

Robert Barnes Dickson, 67, president and director of Kewanee Boiler Corp and a member of the board and executive committee of American Radiator & Standard Sanitary Corp, died April 6 in Kewanee, Ill.

Francis I Kemp, manager of Vertical Turbine Pump Div, Worthington Pump & Machy Corp, Harrison, N. J., died suddenly April 14 at his home.

Robert Case Bennett, Sr, 50, president of I A Bennett & Co, newly merged with National Electric Products Corp, died May 1 in Chicago.

Walter E Poor, 64, chairman of the board of Sylvania Electric Products Inc, died April 4 at St. Lukes Hospital, New York City.

Irving H Reynolds, 88, retired Allis-Chalmers executive, died April 19 in Milwaukee, Wis.

L D Holland, 46, assistant to the president and a member of the board of E F Houghton & Co, Philadelphia, died April 14 after a long illness.

Wilbur F Pray, 50, New York district sales manager, Askania Regulator Co, died April 16 in Boston.

Jared P Morrison, 73, retired boiler expert for Hartford Steam Boiler Inspection & Insurance Co, died April 16 at Redondo Beach, Calif.

Edwin S Webster, 82, co-founder and retired chairman of Stone & Webster Inc, construction engineering firm, died May 10 at his home in Chestnut Hill, Newton, Mass.

British Electricity Authority has placed contracts in Italy for nearly 4000 low-pressure water valves for British power-station service. All British manufacturers have a heavy backlog of orders as a result of the Ministry of Health's houisng projects.

Fourth in a series of **World Power Conferences** will be held in London between July 10 and 15. Its theme is World Energy Resources and the Production of Power. There will be three major divisions: Energy Resources and Power Development, Preparation of Fuels, and Production of Power. First division has only one paper scheduled, a report from each of the national committees. Second division divides into three subdivisions and 18 more detailed classifications. The last breaks up into nine parts, and 16 subcategories of papers.

we'll take the "Red Ink" out of your motor repair shop

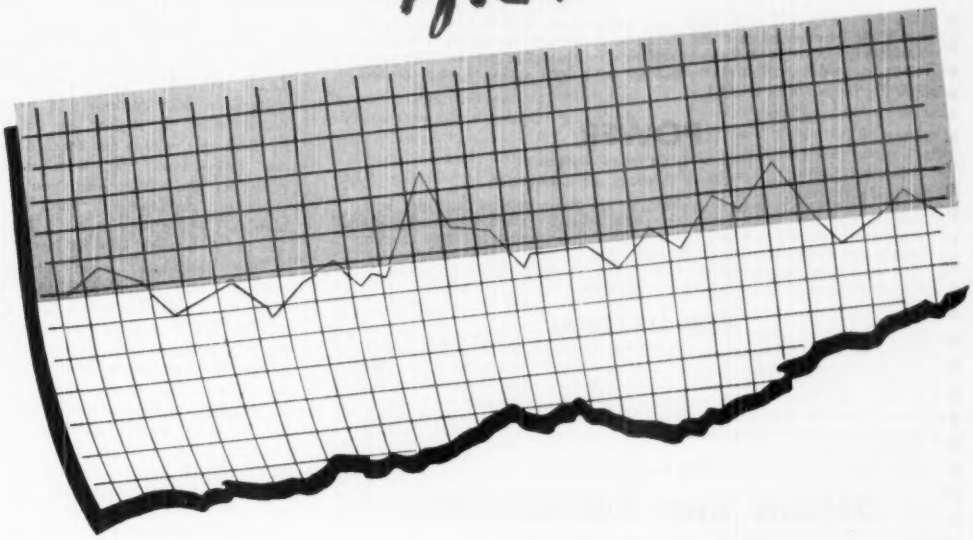


Chart the week-to-week demand and the week-to-week costs of your motor maintenance-repair shop and you'll find that the red ink is concentrated at the periods of peak demand. Normally, the shop probably operates efficiently. But the peak demands cost overtime, and rushed, slighted work. To overcome that condition you'd have to over-equip and over-man your shop. And that means higher cost every day. Many industrialists and generating plants, on the other hand, are operating such shops with very high efficiency. They are equipped and manned to handle the normal demand; they turn over the peaks — the red ink jobs — to us. Thus they avoid the vicious circle of excessive labor costs and excessive overhead. They get work, too, comparable to the best they can do themselves. We've done so much industrial and electrical utility work we know how; we're efficient; our costs are low. That means *your* costs are low, both in your shop and in ours. Our engineers will be glad to come to your office to suggest experienced ways and means of taking the top costs out of *your* motor and generator work. Just drop us a line for quick action.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS MAKERS OF ELECTRICAL COILS AND INSULATION — REWINDING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

Now — a NEW edition

Offers the latest, reliable data on every important topic —

KENT'S MECHANICAL ENGINEERS' HANDBOOK

TWELFTH EDITION (In Two Volumes)

The new "KENT" contains 20% more information—entirely rewritten to include the most recent data and the latest practice. It reflects the knowledge and experience of 172 leading engineers in the fields covered. The data, formulas, tables, and practice described have been compiled from reliable sources and carefully checked.

POWER

Edited by J. KENNETH SALISBURY
General Electric Company. 80 Contributors.

This volume covers: Basic components of any power process (air, fuel, heat, and steam); the service functions, pumping and piping; Power-producing equipment (boilers, turbines, condensers, and gas turbines); Refrigeration, heating, ventilating, and air conditioning; Transportation (diesel engines, land, air, and marine transportation); Electric power; Atomic power, instrumentation, power test codes, and mathematical tables.

NEW MATERIAL

New data is included on basic Nuclear Engineering; Gas Turbines material, with applications to aircraft, power, locomotive, and marine installations; data on Coals from major American mines; 20 greatly-enlarged sections of the Mollier chart (never before available); tables of Theoretical Steam Rates; Heat Gain in air-conditioning applications; abundant illustrative and tabular data on Diesel Locomotives; and comprehensive treatment of Air and Marine Transportation.

May 1950 **1409 pages plus index** **$8.50**

DESIGN AND PRODUCTION

Edited by COLIN CARMICHAEL, Editor,
"Machine Design". 92 Contributors.

Covers: Selection of Materials, Design Principles, Design and Selection of Machine Components, Production Processes, Production Plant Equipment, and Mathematical Data.

NEW SUBJECTS ADDED TO 12TH EDITION

New data is included on Servomechanisms; Industrial Electronic Control; Statistical Quality Control; Measurement and Designation of Surface Quality; Plastics; Plastics Molding; Static and Dynamic Pressure Seals; Precision Investment Casting; Powder Metallurgy; Shot Peening; Brazing; and Adhesives and Glues.

May 1950 **1611 pages plus index** **$8.50**

Volumes may be purchased separately.

SEND FOR BOOKS FOR 10 DAYS' EXAMINATION

ON APPROVAL COUPON

JOHN WILEY & SONS, INC., Dept. P-6-50
440 Fourth Avenue, New York 16, N. Y.

Please send me, on 10 days' approval, copies of KENT'S MECHANICAL ENGINEERS' HANDBOOK, as checked below:

☐ POWER ☐ DESIGN AND PRODUCTION

If I decide to keep the book(s), I will remit $8.50 each plus postage; otherwise I will return the book(s) postpaid.

Name .....

Address .....

City .....Zone .....State .....

Employed by .....

(Offer not valid outside U. S.)

Welding Loads

(*Continued from page* 96)

points on the plant power-supply system may help some. But shunt capacitors on welding machines are expensive to install and raise some complications. Unless capacitors are precharged close to line voltage, inrush current can cause very high current surges that may damage ignitron tubes and produce light-flicker troubles. When it comes to switching capacitors on and off, you set up harmonics and they can develop dangerous voltage surges. As far as harmonics go, you need not worry unless you have electronic-heat controls.

Series capacitors have been used on certain welding applications for power-factor correction. They increase the voltage on both controls and welding transformers. So if they are not held in check this voltage can reach dangerous proportions. But with suitable protection and voltage regulation series, capacitors are practical. Their cost is high. Yet where light flicker is a problem the investment may be justified.

They introduce some problems, though. Some installations have had difficulty in obtaining a consistent weld quality. When the secondary circuit reactive component is canceled out the circuit becomes much more sensitive to resistance changes. Any slight change in welding conditions affects welding current much more than if no series capacitor were in the circuit. Any material change requires alterations in the capacitor bank because kva demand and power factor are quite different.

Supply Transformers. Required rating of the supply transformer for the welding load depends on (1) portion of system voltage drop permissible in the transformer and (2) thermal load it will carry. Usually you add the thermal or rms kva of nonwelding loads directly to the equivalent continuous thermal kva of the welding load to get part (2) in the above.

The nature of other loads coming off the supply transformer determines what portion of system voltage drop is permissible, *above*. For instance, in no case should a multitransformer welder be connected to a distribution transformer supplying a lighting load. Motor loads can tolerate more severe voltage dips than lighting or welding loads. In fact, induction and synchronous motor loads connected to a welder bus help reduce and stabilize voltage drops caused by resistance welders.

When a plant power-supply system can't handle welding loads without interference to other loads, it pays to put in a low impedance transformer to supply the welding load only. The same solution works where the welder is in a remote point in the plant.

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Effect of Water Velocity on Condenser Tube Life

Does the water velocity affect the corrosion rate of condenser and heat exchange tubing? Experience has shown that water velocity is a very important factor, but there are many other contributing elements which must be taken into account, such as the temperature, fouling organisms and the character of the water—degree of salinity, pH value, amount of gases such as oxygen, hydrogen sulfide, carbon dioxide and others; concentration of foreign matter such as sand, cinders, shells, oil. The corrosion resistance of the condenser tube alloy itself also plays a very important part.

Effect of High Water Velocities

Increased water velocities and turbulence may result in impingement corrosion failure which is brought about by the impact of the water on the metal surface. This type of attack is generally recognized by the presence of almond or crescent shaped pits, undercut at one end, and usually free from corrosion products in the pits themselves.

Continued impingement of the stream against the tube in one spot leads to the removal of normal corrosion film until the base metal is exposed which then corrodes at a much higher rate than normal.

Impingement Corrosion Destructive

Impingement corrosion is most commonly found at the point of impact which is generally near the inlet end of the tubes where turbulence is present due to the restriction and speed-up of the water stream as it enters the tubes from the water box. Pieces of shells, stones, coke and other foreign matter lodged in condenser tubes may cause the water to be deflected against the opposite side of the tube, resulting in impingement corrosion at that point.

The presence of sand and entrained gases leads to increased attack. Water carrying sand or silt, in the absence of direct impingement may produce a scouring or abrasive action which may in time seriously reduce the wall thickness of the tubes.

Entrained bubbles of gas greatly increase the rate of impingement. This

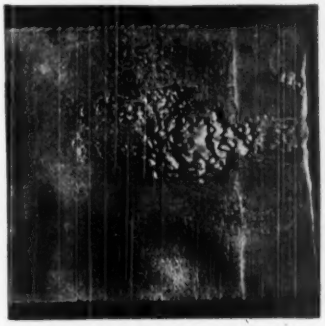


Figure 1. Illustrating impingement corrosion at inlet end of Admiralty condenser tube. Tube has been split lengthwise and flattened.

is aggravated in sea water by the presence of hydrogen sulfide resulting from bacterial action on organic material. Impingement corrosion can be reduced by removing entrained gases from corrosive water by various devices used for this purpose.

Obviously, whatever can be done to remove these disturbing influences will lengthen tube life. It is desirable to keep intake tunnels clean and use fine screens to prevent shells and debris from entering the tubes.

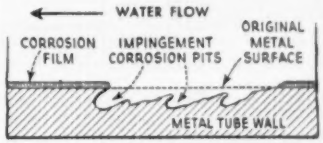


Figure 2. Section through wall of tube shows how impingement of stream removes corrosion film and corrodes base metal to form crescent-shaped pits.

Effect of Too Low Water Velocities

Water velocity which is too low, may be troublesome because it permits the attachment of slime, marine growth, barnacles, mussels and other foreign matter to attach themselves to the tube wall. Once this condition is established, higher velocities cannot readily remove them. However, high water velocities usually prevent larger marine organisms from obtaining a foothold.

Slime is undesirable because it cuts down heat transfer, bringing about a drop in vacuum which may waste fuel.

Low water velocities encourage the settling of sand, clay and other foreign materials on the tube surface and contribute to damage from pitting. It may be necessary to use settling basins, screens or strainers in order to eliminate debris from the water before it reaches the condenser. Speeding up the water may prevent settling in the tubes but opens up the possibility of encouraging impingement corrosion at the inlet ends of the tubes.

Steps used to keep tubing free from slime and other foreign attachments include periodical chlorination, cleaning with rubber plugs, brushes, high pressure water jets or other methods.

Influence of Condenser Tube Alloys

Experiments over a long period of time indicate that alloys vary considerably in their resistance to impingement corrosion. Aluminum brass is superior to Admiralty tubing in resisting this type of attack. Cupro Nickel has proven to be excellent in resistance to corrosion from sea water flowing at high velocities. Duronze IV, Arsenical aluminum bronze is giving a fine account of itself in resisting this type of attack.

Bridgeport maintains an active corrosion research laboratory for studying the behavior of copper-base alloys in corrosive environment. Call on our nearest district office for further information on condenser and heat exchange tubing.

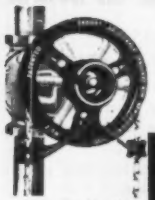
BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • ESTABLISHED 1865

Mills at Bridgeport, Connecticut, and Indianapolis, Indiana • In Canada: Noranda Copper and Brass Limited, Montreal

(Advertisement)

Overhead Valves EASILY, QUICKLY AND SAFELY controlled from the FLOOR!

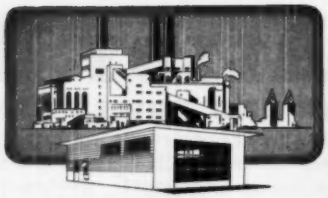


A Range of 10 adjustable sizes takes care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches.

Babbitt *Adjustable* SPROCKET RIM *with Chain Guide*

- No more climbing up treacherous step-ladders, on benches, machines or boilers. High-up, inaccessible valves are brought down to earth by the inexpensive BABBITT Adjustable Sprocket Rim with Chain Guide. Here's overhead valve control that is just as positive as direct manual control, and 100% safer—right from the floor!
- The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.
- *Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.*

BABBITT STEAM SPECIALTY CO.
1 Babbitt Square, New Bedford, Mass.



Industrial Sound Control

QUIETS POWER PLANTS

ENDS ANNOYANCE COMPLAINTS LOW EMPLOYEE MORALE THREATS OF LEGAL ACTION
Due to Disturbing NOISE

Whether your equipment serves a city of millions, a small town, or just your own plant, ISC can solve the noise problem quickly and inexpensively. Investigate today.

Write, wire or phone us for full information on your problem

INDUSTRIAL SOUND CONTROL
45 Granby St., Hartford, Conn.
2119 Sawtelle Blvd., Los Angeles, Calif.

Monsanto SANTOSITE stops oxygen corrosion in boilers

Santosite (Monsanto sodium sulfite anhydrous, technical) removes dissolved oxygen from boiler feed water . . . puts an end to steam plant damage and shutdowns due to oxygen corrosion. Santosite is economical . . . efficient . . . easy to apply.

If oxygen corrosion is a problem in your boilers, you will profit from reading Monsanto Technical Bulletin No. O-26. For your free copy, contact the nearest Monsanto Sales Office or write: MONSANTO CHEMICAL COMPANY, Desk B, Organic Chemicals Division, 1763 South Second Street, St. Louis 4, Missouri.

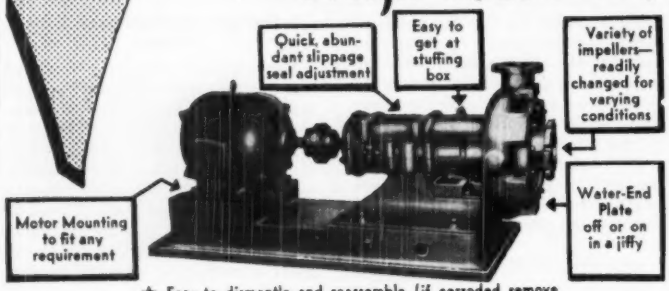
Santosite: Reg. U. S. Pat. Off.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

MONSANTO
CHEMICALS - PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

Check these NAGLE ASH HANDLING PUMP Design Features!


Quick, abundant slippage seal adjustment
Easy to get at stuffing box
Variety of impellers—readily changed for varying conditions
Motor Mounting to fit any requirement
Water-End Plate off or on in a jiffy

- ★ Easy to dismantle and reassemble (if corroded remove bolts with acetylene torch.)
- ★ Repairs made on the spot.
- ★ Plenty of room for packing.
- ★ Assemble from either side, or from above.
- ★ Does not have to be level—even hang it on wall or ceiling.

NEW Catalog 4906 gives other features!

Nagle Pumps
INDUSTRIAL PUMPS FOR ABUSIVE APPLICATION
1251 Center Ave., Chicago Heights, Ill.

29 Coal Mines and Power Plants Report...

1. A total of 61,161,372 tons crushed.
2. Average age of American Crushers at time of survey — 9.35 years.
3. Average parts replacement cost $.0012 per ton (includes cost of standby parts not yet needed).

CONCLUSION:

AMERICANS CAN "TAKE IT"! NEEDING NEW PARTS *LESS OFTEN*, THEY KEEP OVERALL PRODUCTION EFFICIENCY *HIGH*.

HERE ARE A FEW CASE HISTORIES

A COAL MINE IN ILLINOIS reports 4,000,000 tons crushed over 10-year period by their American AC3-E Crusher — with a parts replacement cost of $.0005 per ton.

AN INDUSTRIAL POWER PLANT IN WEST VIRGINIA has an American 38-S Crusher that has reduced 10,008,000 tons over last ten years. Parts replacement cost was only $.0008 per ton.

A CENTRAL STATION IN NEW JERSEY crushed 6,000,000 tons over a 20-year period with their American 42-S. Parts replacement cost was only $.00025 per ton. Crusher still going strong.

CRUSH COAL AT A TOTAL COST OF LESS THAN 1¢ PER TON

ORIGINAL COST of an American Crusher . . . plus MAINTENANCE . . . plus POWER . . . plus INTEREST ON INVESTMENT averages less than 1¢ per ton crushed. The American Pulverizer Company has many case studies to prove this fact.

Let an American Representative analyze your crushing problem. Write for details on the complete line of American Crushers.

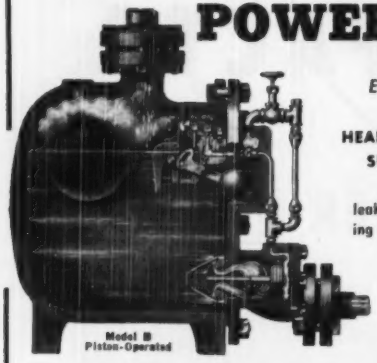
American

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 MACKLIND AVE.
ST. LOUIS 10, MO.

Nicholson Super-Trap for

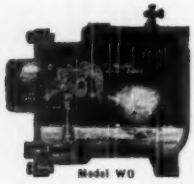
POWER SERVICE



Especially Recommended for
STEAM PURIFIERS, HEADERS, SEPARATORS, HEATERS, SUPERHEATED STEAM LINES

leak even if cooked dry; rugged; working parts of stainless steel. Pressures, 2 to 650 lbs. The lowest price large capacity trap.

Thousands of installations attest to the enormous drainage capacity of this Nicholson trap. Piston-operated and with valve orifices up to 2" diam., it discharges large volumes of water almost instantly. Other features: won't



NICHOLSON WEIGHT - OPERATED TRAPS—Three models for press. to 200, 650 and 1500 lbs.; for steam, air, gasoline. Also feature large capacity and proof against leaking.

Catalog 250 or see Sweet's

W. H. NICHOLSON & CO.
125 Oregon St., Wilkes-Barre, Pa.

FOR YOUR CONVENIENCE

When you are looking for

the answers to

"What's available?"

"Who makes it?"

"Where can I get it?"

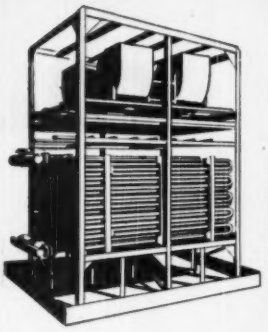
—you'll find them quickly

and easily in the

1950 Mid-June

POWER Buyers' Guide Number

WATCH FOR *YOUR* COPY



How to Improve Operating Efficiency of Evaporative Condensers

SOONER or later make-up water, used in evaporative coolers and condensers, becomes slime laden. Quick remedy is needed here to maintain trouble-free operation of air conditioning equipment. A most effective way to fight slime and side-step trouble is water-treatment with OAKITE SANITIZER No. 1.

This new, germicidal agent of the quaternary ammonium type destroys bacterial organisms and discourages slime growth.

FREE: Handy 20-page Guide contains many practical suggestions on low-cost maintenance of air conditioning and refrigerating equipment. Send for Booklet No. F 7383. No obligation.

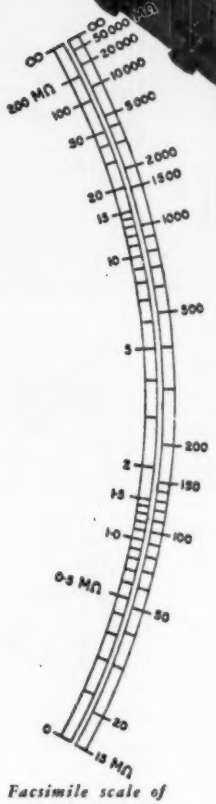
OAKITE PRODUCTS, INC.
23 Thames St., N. Y. 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE
Technical Service Representatives Located in Principal Cities of United States and Canada

UP TO 50,000 MEGOHMS

with the New *Megger*® Insulation Tester

New Higher ranges
Wider ranges
Longer scales
Improved Mechanical Features



Facsimile scale of 2,500-volt instrument

Never before has the direct-indicating cross-coil ohmmeter been capable of measuring such high values of insulation resistance!

This accomplishment comes at a time when more attention than ever is being focused by engineers on insulation resistance or d-c loss measurements as a practical non-destructive means of forestalling breakdown in electrical equipment.

These new sets also include several important improvements, such as static shielding, improved hand-drive mechanism, and a simplified design for motor-drive with better voltage stabilization.

The new line of MEGGER Insulation Testers is now available in the following ranges:

Volts	Inner Scale Megohms	Outer Scale Megohms
500 volts d-c	0 to 50	3 to 10,000
1,000 volts d-c	0 to 100	6 to 20,000
2,500 volts d-c	0 to 200	15 to 50,000

For unusual requirements, a special 5,000-volt instrument is available with range up to 100,000 megohms.

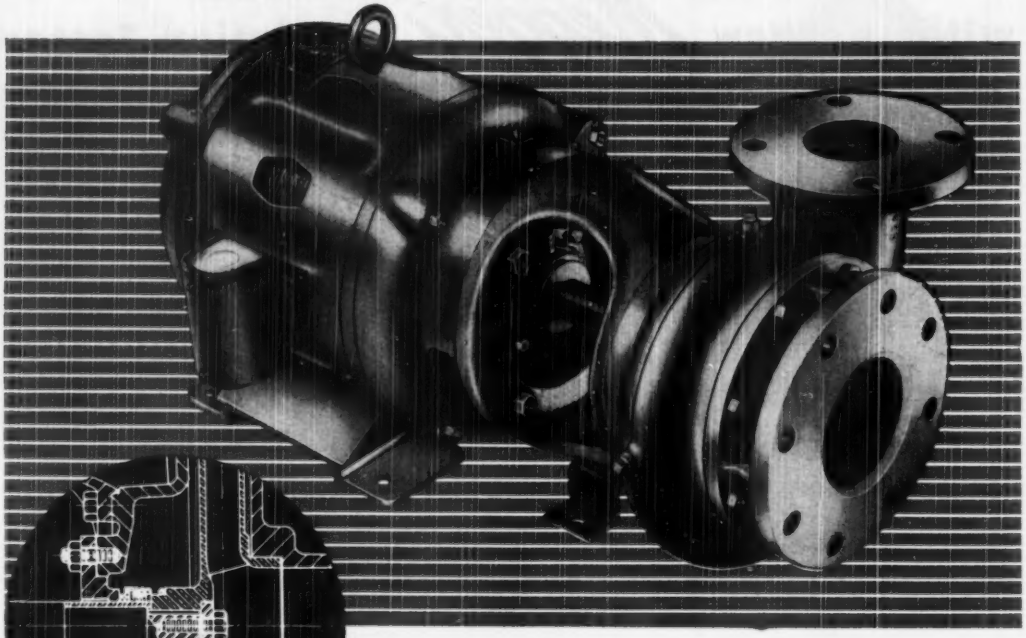
For description and prices, *write for Bulletin 21-20-P.*

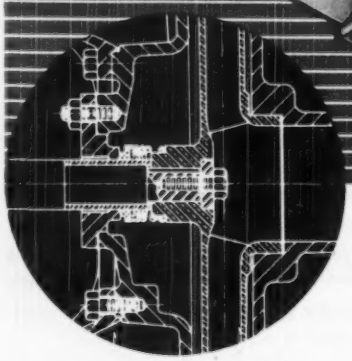
JAMES G. BIDDLE CO.
Electrical & Scientific Instruments
1316 ARCH STREET, PHILADELPHIA 7, PA.

"Megger"® INSULATION TESTERS • GROUND TESTERS • OHMMETERS

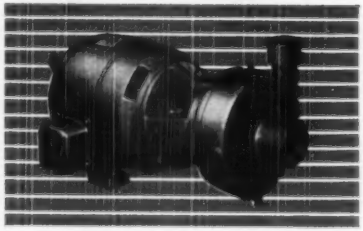
NO DRIP FROM THIS IMPROVED PACKLESS PUMP

MECHANICAL SEAL ENDS USUAL PUMPING TROUBLES





Cross-section of B & G Mechanical Seal



B & G SERIES 1522 CENTRIFUGAL PUMP

Another B & G Pump with outstanding qualifications! Seven big features: Standard Motors—Mechanical Seal—Spring type Flexible Coupling—Interchangeable Parts—Compact Design—Easy Servicing—Competitive Price. Available as all-iron, bronze fitted or all-bronze units.

B & G SERIES 1531 CENTRIFUGAL PUMP

It will be worth your while to look into the outstanding advantages of the B&G Series 1531 Centrifugal Pump. This unit features a Mechanical Seal which assures trouble-free operation under tough pumping conditions.

The Mechanical Seal adds materially to length of service, especially where the pumped liquid contains foreign matter which is damaging to the ordinary stuffing box. The Seal is *self-lubricating* and eliminates the customary leakage through the packing gland.

You'll also like the painstaking workmanship found in the B & G Series 1531 Pump. All parts are machined to rigid specifications and accurately assembled. Quick and easy replacement in the field is assured by positive uniformity throughout. High hydraulic efficiency is obtained throughout the capacity range and all pumps are shop tested for conditions of head and capacity specified.

Send for complete engineering data.

SEND FOR THESE CATALOGS OF B & G CENTRIFUGAL PUMPS

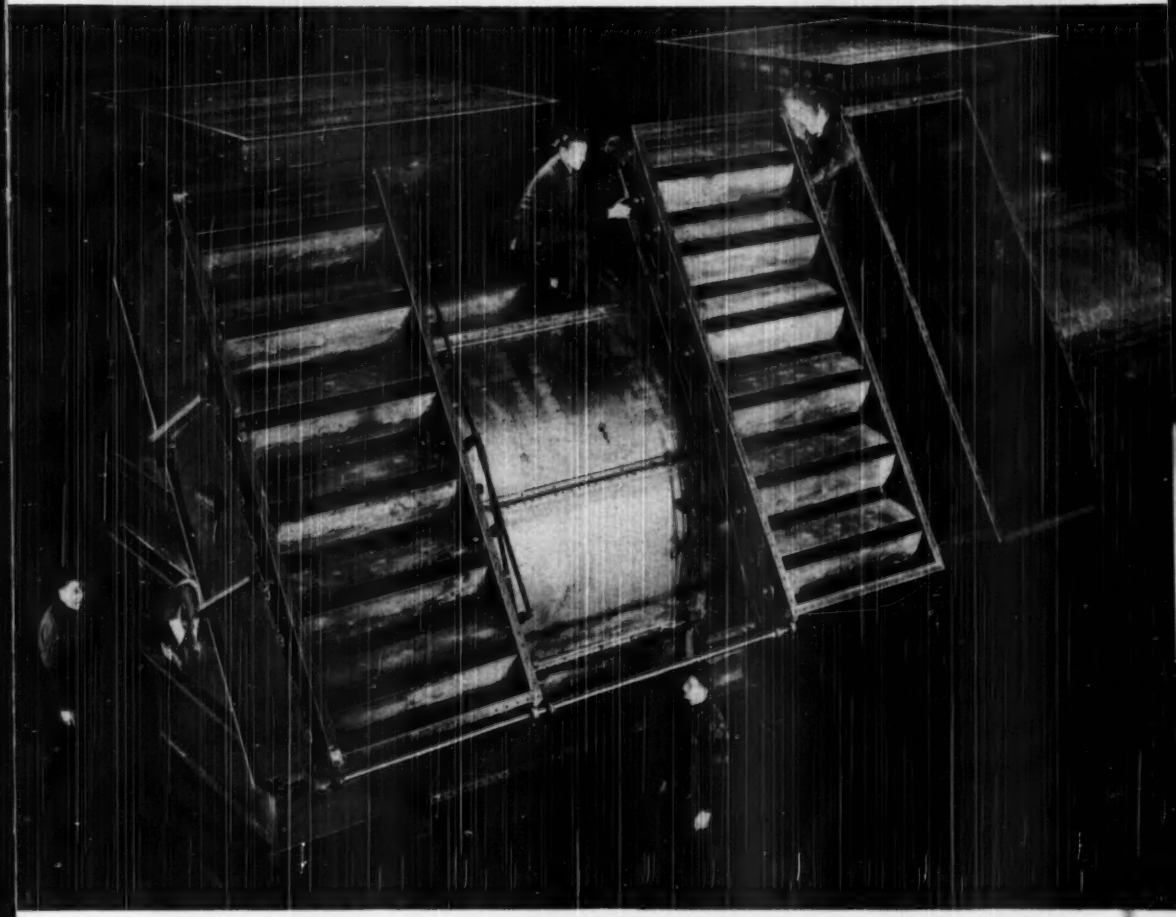
B & G

Hydro-Flo®

CENTRIFUGAL PUMPS

BELL & GOSSETT CO. • Dept. BN-36 • Morton Grove, Illinois

Big Reason For Cheap Electricity!

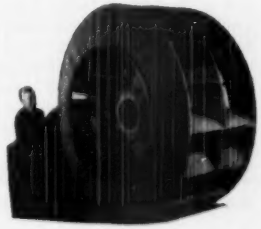


"Buffalo" Induced Draft Fan--

one of six being built for prominent power company. 16′ 2″ high, it has a rated capacity of 202,500 cubic feet a minute against 15″ static pressure. In service, a continual storm of fly ash will pass through this fan. That's why "Buffalo" builds Induced Draft Fans ruggedly — to stand power plant service the maximum time without repairs or shutdowns. And that means lower power costs! Note "Buffalo" Paraflow Dampers on inlets and outlet for accurate draft control.

Big Wheel in the Power Industry!

At right, the 12½ ft. wheel for the fan shown above. Note heavy plate construction with welded-on wearing strips on blades. The wheel takes the beating in draft work—that's why "Buffalo" wheels are TOUGH!



WRITE FOR FACTS! Dependable draft is a fundamental way to keep power costs down. Pick "Buffalo" Forced and Induced Draft Fans and be sure! Write for Bulletins 3113-A and 3190-B for all the facts.

BUFFALO FORGE COMPANY

488 Broadway Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in All Principal Cities

MERCOID

AUTOMATIC CONTROLS FOR INDUSTRIAL APPLICATIONS REQUIRING POSITIVE CONTROL OF PRESSURE, TEMPERATURE, LIQUID LEVEL ETC.

SIMPLE TO ADJUST FOR THE SPECIFIED OPERATING RANGE

MERCOID CONTROLS ARE EQUIPPED WITH MERCURY SWITCHES, THEREBY INSURING GREATER SAFETY, BETTER PERFORMANCE AND LONGER CONTROL LIFE

WRITE FOR CATALOG 600-B.

THE MERCOID CORPORATION
4201 BELMONT AVE. CHICAGO 41, ILL.

New Printing Available

STEAM TURBINES

Because of continuing demand for this comprehensive and authoritative special section, we have just made an additional printing and can now supply new orders. Price remains the same: 60¢ for single copies, 51¢ for 100 or more, 46¢ for 500 or more, 41¢ for 1000 or more, and 37¢ for 2000 or more.

Address your orders to:
Editorial Dept.

POWER

330 W. 42nd St., New York 18, N. Y.

GEAREX ROTARY PUMPS move more—for less!

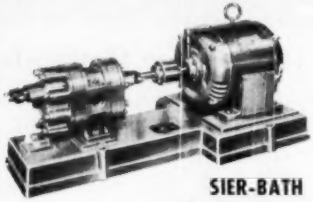
Only 2 Moving Parts!

Rotating Element of GEAREX Pump

Photo shows the "heart" of a Gearex Pump. It provides **more displacement** per revolution because rotors do not transmit power—are designed to fulfill just **one** function: moving material. It means **less maintenance** because (1) rotors never touch metal (2) proper rotor clearance is accurately maintained by Sier-Bath **precision cut** timing gears.

ADDITIONAL ADVANTAGES

- Pulseless flow
- Vibrationless operation
- Low pressure on stuffing boxes
- Direct connected up to 1800 RPM
- Available in corrosion resistant alloys
- Horizontal or vertical construction



SIER-BATH GEAREX PUMP

Two general types: **INTERNAL BEARING TYPE** (above) for lubricating liquids, **EXTERNAL BEARING TYPE** for non-lubricating liquids. Capacities: 1-550 GPM. Discharge: 250 PSI for viscous liquids, 50 PSI for water. **SIER-BATH SCREW PUMPS** for higher pressures and capacities.

Write for Booklet

FOUNDED 1905 MEMBER A.G.M.A.

Sier-Bath GEAR and PUMP CO., Inc.
9254 HUDSON BLVD., NORTH BERGEN, N. J.

LARGER STOCKPILES with LESS LABOR

Above is 15,000-ton stockpile handled by small Sauerman unit. Scraper moves coal into and out of storage at rate of 75 tons an hour.

CUT STORAGE COSTS with Sauerman

For rapid handling of large tonnage, standard Sauerman Scraper machine is equipped with mobile tail tower which circles the storage area.

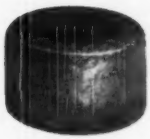
POWER DRAG SCRAPER

Storage of any desired tonnage of coal is an easy, comfortable one-man job with a Sauerman Power Drag Scraper. This equipment makes full use of any ground space with little advance preparation. It stacks the coal in compact layers, so there are no air pockets to encourage spontaneous combustion. Everything about the equipment is simple and it gives continuous satisfaction with a minimum of attention. Hundreds of operators report that their Sauerman machines are as good as new after many years of service with annual repair costs running as low as one-half cent per ton handled. *Engineering Catalog free on request.*

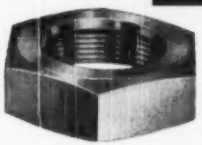
SAUERMAN BROS., Inc. 562 S. CLINTON STREET CHICAGO 7, ILLINOIS

Toothed Lock Washer: Prevents loss of stem nut due to vibration, thereby holding the handwheel securely.

Newly Designed Handwheel: Air-cooled, finger grip handwheel affords sure grip even with greasy gloves.

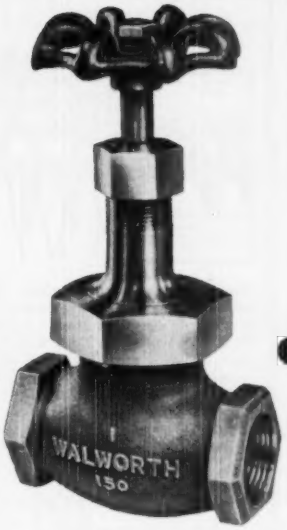


Improved Packing: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure.



Hexagonal Union Bonnet Connection: Eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and assembled.

WALWORTH



IMPROVED
No. 95
BRONZE
GLOBE VALVE

also available in Angle Type (No. 96)

The service ratings of the Walworth No. 95 are 150 pounds per square inch steam at 500F, and 300 pounds per square inch non-shock cold water, oil, and gas. In the manufacture of this quality bronze valve, more than 47 gages are used in machining parts to micrometric accuracy, thus insuring interchangeability of parts. For further information see your local Walworth distributor, or write: Walworth Company, 60 East 42nd St., New York 17, N. Y.

note these 7 Great Features

WALWORTH
valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

New Cylindrical Disc Holder: The design of the top portion of the disc holder keeps the disc accurately guided under all operating conditions.

Renewable Asbestos Disc: This disc is suitable for steam up to 500F and is resistant to oil, gasoline, and many chemicals at atmospheric temperatures. Discs for special services are available.

Extra Strong Body: Made of Composition M (ASTM B61) bronze thick enough to provide a high safety factor. Valves undergo hydrostatic shell test of 450 psi.

"GUNITE" Concrete

(SINCE 1918)

Linings for

STEEL BUNKERS •
DUCTS, HOPPERS •
STACKS •
UPTAKES •
BREECHINGS •

• • •

STEEL & PIPE ENCASEMENT

• • •

FIREPROOFING •

GUNITE CONCRETE & CONST. CO.

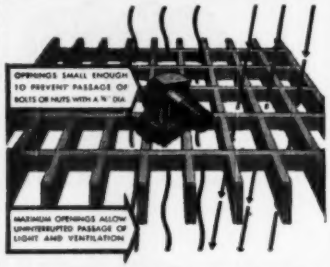
1301 Woodswether Road
KANSAS CITY 6, MO.

R. N. Turner, Dist. Mgr., 228 No. La Salle St., Chicago 1, Ill. S. H. Mueller, Distr. Mgr., 6625 Delmar Blvd., University City, (St. Louis), Mo. Phillip D. Barnard, Distr. Mgr., 2008 Addison, Houston 6, Tex.

Branch Offices: New Orleans, Dallas, Denver.

"See our catalog in Sweet's"

TRI-LOK RECTANGULAR OPEN STEEL FLOORING


OPENINGS SMALL ENOUGH TO PREVENT PASSAGE OF BOLTS OR NUTS WITH A ¾" DIA.
MAXIMUM OPENINGS ALLOW UNINTERRUPTED PASSAGE OF LIGHT AND VENTILATION

Tri-Lok strength is obtained by truss action through twisted cross-bar, curved in opposite directions at each bearing-bar. Standard openings in Tri-Lok Rectangular Steel Flooring are 1" x 3⅞"—other size openings can be supplied as required.

Diagonal, or Super-Safety U-type Flooring, and stair treads of all types, are available. Bulletin KF 1140 describes the construction features of Tri-Lok Open Steel Flooring.

DRAVO CORPORATION

National Distributor for the Tri-Lok Company

Dravo Bldg., Pittsburgh 22, Pa.

Sales Representatives in Principal Cities

DRAVO

Changing Address ?

- If you are planning to move, please be sure to let our Circulation Department know about it — and as far in advance as possible.
- It takes time to correct the stencil addressing plate and to make the correction on all our records. So your prompt notification will help us make sure you do not miss copies of POWER.
- Be sure to give us your OLD address as well as your NEW address. We need them *both* to make the correction.
- Mail in the coupon if you plan to move. And please fill it in as completely as possible.

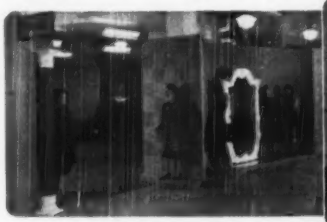
THANK YOU!

Circulation Dept.
POWER
330 West 42d St.
New York 18, N. Y.

Change of Address Notice
(PLEASE PRINT)

On or about_____
my NEW address will be . . .
Street _____
City _____ Zone_____
State _____
My OLD address was . . .
Street _____
City _____ Zone_____
State _____

_____
Name Here



Buffalo's Largest Store Air Conditioned throughout with Frick Refrigeration

Sattler's Department Store, covering most of a large city block, serves up to 150,000 people in a single day. The giant store is cooled in hot weather with ten Frick ammonia compressors using 920 horsepower. Installation by Mollenberg-Betz Machine Company, Frick Sales Representatives at Buffalo.

Ten Frick Compressors Are Installed on the Roof of Sattler's Store at Buffalo.

For that important air conditioning, ice-making, refrigerating or quick-freezing job of yours, get in touch now with the nearest Frick Branch or Distributor.

FRICK CO. WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery

Carbon • Alloy • Stainless Steel
ARTERIES for any heat transfer unit

B&W SEAMLESS AND WELDED
heat exchanger and condenser TUBES

QUICK SERVICE on your tubing requirements for original equipment or replacement is available from your nearest B&W Tube representative and through local distributors in principal cities.

Write for new Bulletin T B 329.

B&W SEAMLESS and WELDED TUBES

TA-1523-C

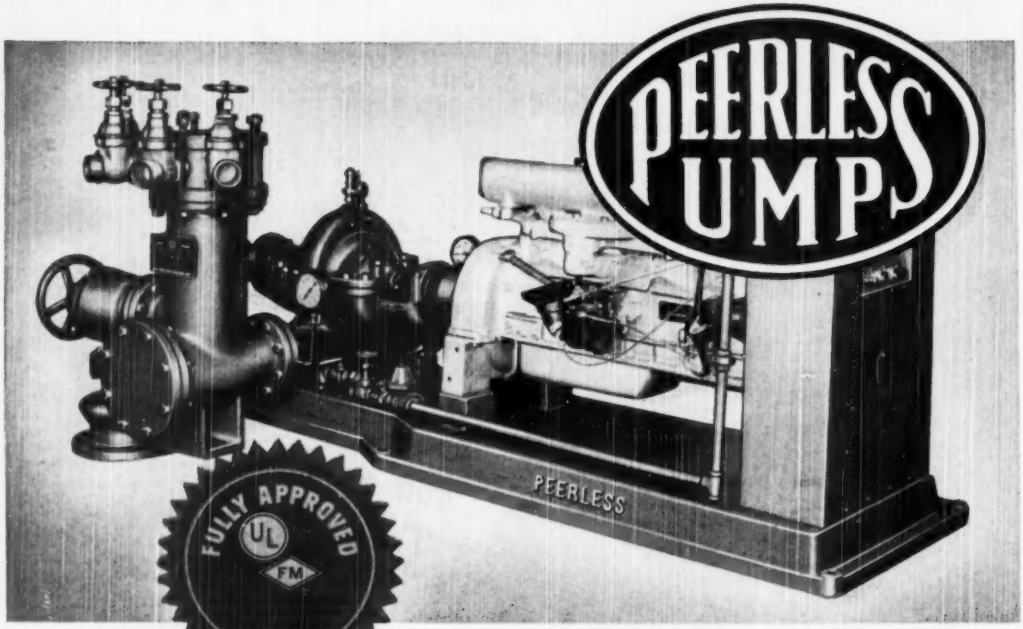
THE BABCOCK & WILCOX TUBE COMPANY

General Offices: Beaver Falls, Pa.

Plants: Alliance, Ohio, and Beaver Falls, Pa.

Sales Offices: Alliance, Ohio • Beaver Falls, Pa. • Boston 16, Mass. Chicago 3, Ill. • Cleveland 14, Ohio • Denver 2, Colo. • Detroit 26, Mich. Houston 2, Texas • Los Angeles 15, Calif. • New York 16, N. Y. Philadelphia 2, Pa. • St. Louis 1, Mo. • San Francisco 3, Calif. • Syracuse 2, N. Y. • Toronto, Ontario • Tulsa 3, Okla. • Vancouver, British Columbia

UNSURPASSED FIRE PROTECTION FOR COMMERCIAL AND INDUSTRIAL RISKS



UNDERWRITERS' APPROVED PEERLESS FIRE PUMPS

HORIZONTAL CENTRIFUGAL AND VERTICAL TURBINE TYPES—Peerless Underwriters' Approved Fire Pumps can be applied to practically every commercial and industrial risk requiring fire protection. They afford dependable, low cost protection, peak quality performance and unquestioned reliability that often will result in measurable savings in insurance cost.

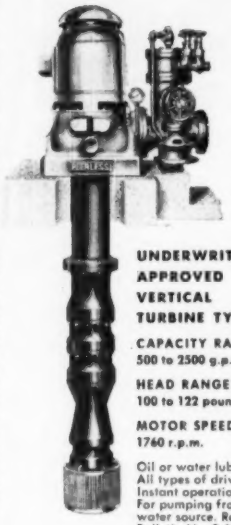
SINGLE AND MULTI-STAGE—Peerless Underwriters' Approved Fire Pumps are available in two types. The Type AF, shown above, is a single stage, double suction, horizontal centrifugal design, with a capacity range of from 500 to 2000 g.p.m., affording pressures, at rated capacities, from 40 to 150 lbs. and is available in 4", 5", 6" and 8" discharge sizes.

The Type TUF is a 2-stage pump available in 4", 5", 6" or 8" discharge sizes and furnishes from 500 to 1500 g.p.m., with a pressure range, at rated capacities, from 100 to 200 lbs.

ALL TYPES OF APPROVED DRIVES—Peerless approved fire pumps may be equipped with any type of drive: electric, steam turbine, gasoline or diesel engine. Auxiliary stand-by engine drives may be used in conjunction with turbine or motor drive to assure instant service even in the event of power failure.

SPRINKLER AND FOAM SYSTEMS—Peerless Underwriters' Approved Fire Pumps are ideal for application to liquid-foam type fire protection systems as well as to conventional sprinkler application; the former is especially desirable for solvent processing plant protection where the split-second control of fire hazards is a must.

NEW 24-PAGE BULLETIN ANSWERS ALL QUESTIONS ON UNDERWRITERS' FIRE PUMPS—Peerless Bulletin No. B-1500 completely describes and illustrates these unsurpassed and approved fire protection pumps. Write for your free copy today.



UNDERWRITERS' APPROVED VERTICAL TURBINE TYPES

CAPACITY RANGE: 500 to 2500 g.p.m.

HEAD RANGE: 100 to 122 pounds.

MOTOR SPEEDS: 1760 r.p.m.

Oil or water lubricated. All types of drives. Instant operation. For pumping from any water source. Request Bulletin No. B-152-1.

PEERLESS PUMPS fmc

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Factories: Los Angeles, California, and Indianapolis, Indiana
Offices: New York, Atlanta, Fresno, Los Angeles, Chicago, St. Louis, Phoenix; Dallas, Plainview and Lubbock, Texas.

When *these* tubes go in, they're in to stay!

CHASE ANTIMONIAL ADMIRALTY

(*a patented alloy*)

Here's the reason *why* Chase Antimonial Admiralty stays on the job year after year:

Admiralty with an antimonial content of less than .007% (the minimum set forth in Chase Patent No. 2,061,921) cannot be depended on to guard against dezincification under all conditions. Over a wide range of applications, protection calls for a minimum of .015%. And Chase boosts the nominal content to .035% . . . to make doubly sure that despite normal commercial variations every tube contains *at least* .015%.

This time-tested Antimonial Admiralty is Chase-patented. Get the facts today.

Special stocks of ANTIMONIAL ADMIRALTY Condenser Tubes in Chase Warehouses: NEW YORK, BALTIMORE, NEW ORLEANS LOS ANGELES, SAN FRANCISCO

also carried by—
Vinson Supply Co., Tulsa
Standard Brass & Mfg. Co., Houston

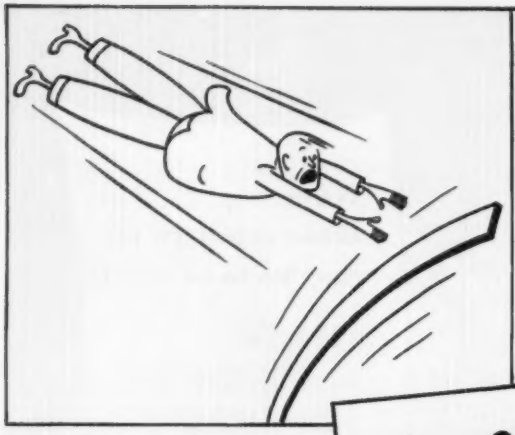
Chase

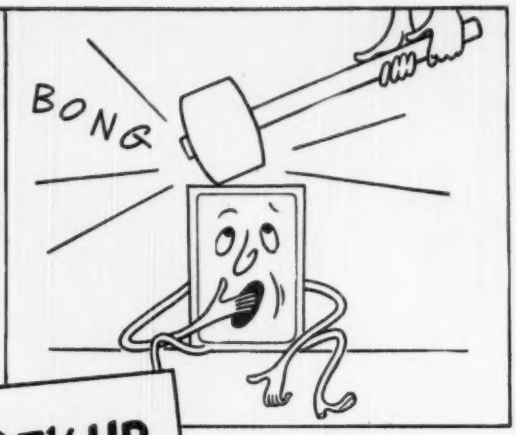
the Nation's Headquarters for
BRASS & COPPER

WATERBURY 20 CONNECTICUT — SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DALLAS DENVER DETROIT HOUSTON INDIANAPOLIS KANSAS CITY MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER ST. LOUIS SAN FRANCISCO SEATTLE WATERBURY





New 2-7½ HP Manual Starters

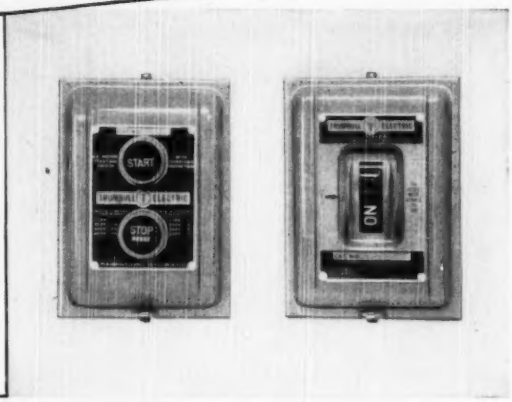
save "crossing your fingers"

Fast-Acting on Overload or Stalled Rotor Conditions

Improved thermal overload device is factory-calibrated to follow normal heating curve of motor. Handles *both* overload and stalled rotor. Trips promptly—the higher the overloads, the faster the response. Choice of 90 heater units in fractional ampere steps.

But It Won't Act When It Shouldn't

Unique latch mechanism minimizes false trip-out. A trigger mechanism gives positive, quick-acting tripping on overload—reacts only to bending of heater strip, not to vibration or knocks. And metal guard protects toggle or push-button from accidental operation.



It's Even Hard for the Operator to Do Wrong

No parts to replace after overload. Contacts cannot be held closed against overload. ON, OFF, RESET positions clearly indicated on toggle type; START and STOP on push-button types. Resetting directions clearly visible on both types. Line and load circuit numbers on barriers between contacts. Covers and toggle can be locked.

PT Means "Push-button or Toggle" ...in All Sizes

All sizes of Trumbull's PT Starter available with push-button or toggle operation in general purpose enclosures. Water-tight or explosion-proof enclosures are also available. Fine silver, butt-type contacts are easily inspected. Write for Bulletin PT. THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn.

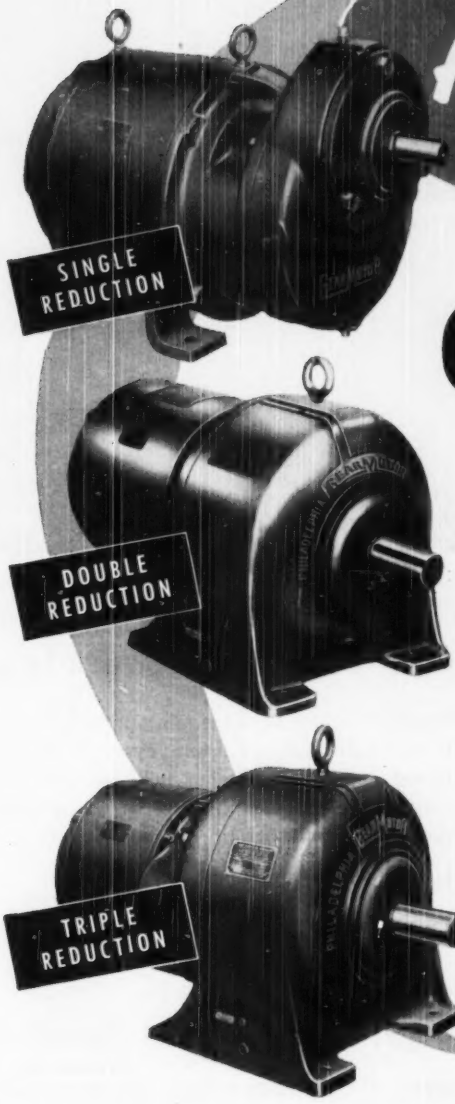
TRUMBULL (T) ELECTRIC

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS

Any Speed YOU NEED

WITH

GEARMOTOR



. . . because it is available in single, double or triple reductions, offering a range of speeds: 780 through 7.5 r.p.m. Motor rating from 1 h.p. through 60 h.p.—A-c or D-c. The motors and gear units are each self-contained and readily separated . . . gears in multi-reduction units may be inspected, without uncoupling from driven machine.

These small, compact, self-contained units simplify the direct application of electric drive to individual machines.

GearMotoR conforms to the recommended standards of the American Gear Manufacturers Association and the National Electrical Manufacturers Association.

Send for 42-page illustrated catalog, containing full information and data necessary for ordering, and please use your Business Letterhead when requesting same.

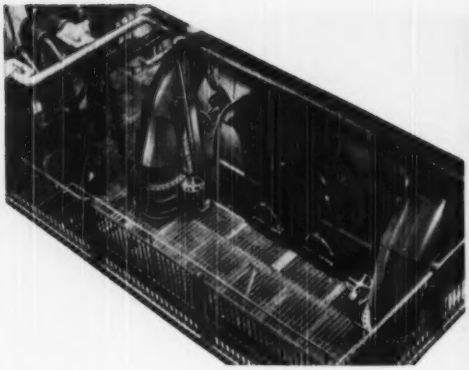
Philadelphia Gear Works, INC.

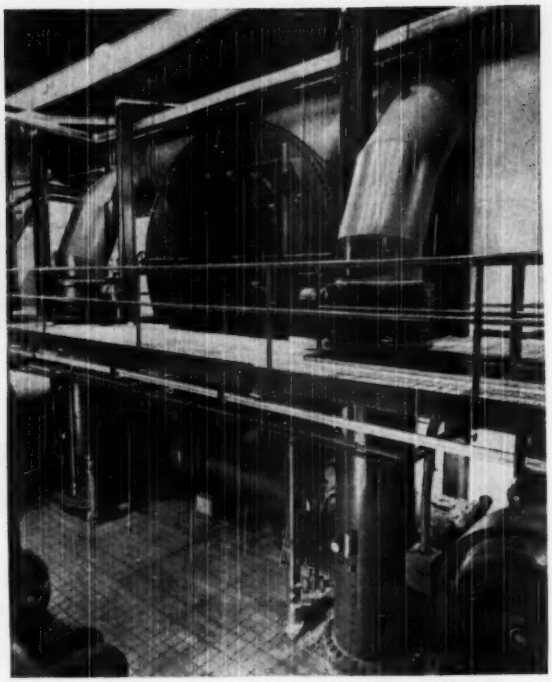
ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON

IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls





CONSECO 33,000 SQ. FT. CONDENSER

SPECIAL FEATURE: Deaerating Hotwell . . . Deep-Water Boxes . . . Large Access Manholes

33000 sq. ft. Divided Flow Condenser. Design based on 100% tube cleanliness and design performance guarantee exceeded in operation. Full Deaerating Hotwell utilized eliminating Deaerating Heater from plant heating cycle.

CONSECO Engineers are specialists on Condensers and Heat Exchange equipment. Every condenser designed and built by us has fully met and exceeded guarantees. The services of this young, progressive organization are at your disposal.

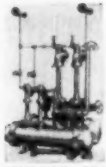
OTHER EQUIPMENT in the CONSECO LINE

BOILERS

DEAERATORS

CLOSED HEATERS

EVAPORATORS



STEAM JET AIR EJECTORS

CONSECO **Condenser Service & Engineering Co.**
HOBOKEN, N. J.

For Retubing and Maintenance Service — Call Our Field Office Day or Night — N. J. HOboken 3-4428, N . Y. REctor 2-9363

FROM THE SMALLEST *TO THE* LARGEST—

Yes, anything you can want in a pressure gauge is at your beck and call in the great line of instruments bearing the most respected name in gauges...MARSH!

Not just any size, but any duty, any case style, any finish, any dial graduations, any mounting. So complete is the line, that gauges which are "special" to other manufacturers, are often standard to Marsh—an important reason for the plus value you get in Marsh instruments.

You may merely need a gauge for ordinary service. Or you may need a gauge that will stand up under tough conditions such as extreme pressure, extreme temperature, corrosion, vibration, pulsation. But whatever the service you have only to select the Marsh Gauge recommended for the specific condition to find the final answer to your instrument problem.

Ask for catalog **covering Marsh products which include: A full line and range of gauges in pressure, compound, altitude, hydraulic, sprinkler, ammonia, ounce-graduated retard, test, and diaphragm types. Dial thermometers in rigid stem and remote reading types. A broad line of steam heating and refrigeration specialties including the Electrimatic line of refrigeration water regulators and solenoid valves.**

MARSH INSTRUMENT COMPANY

Sales affiliate of JAS. P. MARSH CORPORATION, Dept. P., Skokie, Ill.
Export Dept.: 155 E. 44th St., New York

Marsh alone has the RECALIBRATOR—quickest and best way to correct a gauge or dial thermometer that has been knocked out of adjustment.

MARSH GAUGES

ILLCO-TEMP SOFTENER AT NATIONAL LOCK

to reduce hardness in hot-process effluent without chemical additions

Power Plant,
NATIONAL LOCK CO.
Rockford, Illinois

For most efficient boiler operation in its new power-plant addition, National Lock solved the problem of after-precipitation and residual hardness in the effluent of its lime-soda softener.

As a result of a pilot-plant test, company engineers recommended the installation of a larger ILLCO-TEMP Softener (10,000 gph) to after-soften the lime-soda effluent without the use of additional chemicals.

The softener (shown at right) operates at 230° F. and has softened over 10 million gallons since its installation.

Exchange capacity of the softener has not declined. Also, through use of zero-soft water in boiler-feed make-up, National Lock has effected a reduction in the cost of chemical additions, as well as increased efficiencies resulting from clean boiler operation.

Write for other case histories and descriptive literature.

Advantages of ILLCO-TEMP

No chemical after-treatment is necessary to reduce hardness . . . with "zero" soft water obtained from the ILLCO-TEMP Hot-Process Unit. Chemical savings from this alone will normally pay for equipment in less than 2 years.

Assures a constant source of "zero" soft water regardless of variations in the raw water or the hot-process effluent.

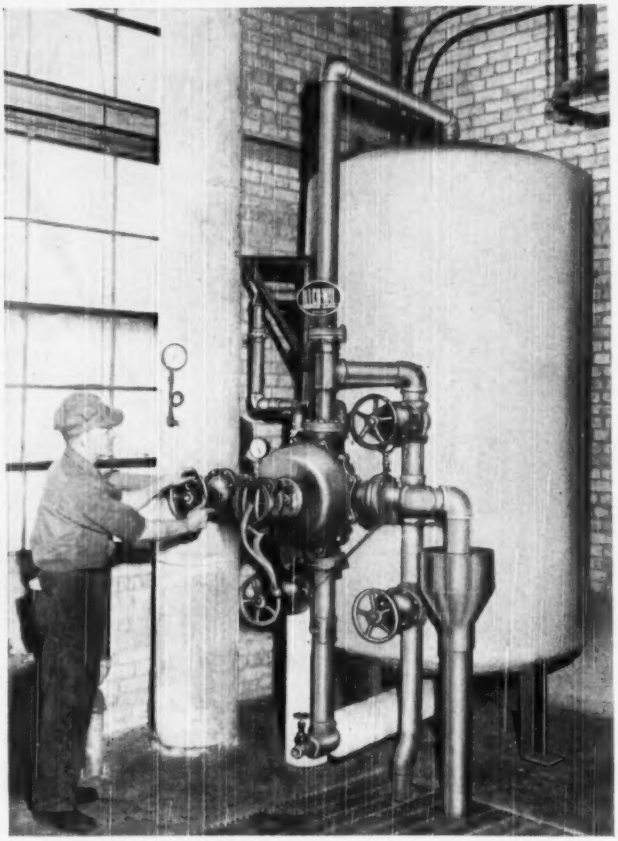
Decreases the excess dosages required for straight hot-process.

Reduces amount of chemicals required in boiler (none needed for hardness control).

Eliminates frequent adjustment.

Eliminates deposits which result in "plugging" in valves, feed pumps, feed lines, heaters, etc.

ILLCO-TEMP unit easily and economically added to your present lime-soda water softener.



ILLCO-TEMP SOFTENER installed in National Lock Company plant operates at 230° F., 10,000 gph.

This is the only method today that withstands high or low pH at high temperatures. The ILLCO-TEMP Softener unit operates economically and continuously at temperatures as high as 250° F. . . . on waters having a pH as high as 10.5. This eliminates the need for a constant control and adjustment of the hot lime-soda dosage, as previously required.

ILLINOIS WATER TREATMENT CO., 853-6 Cedar St., Rockford, Ill.
New York Office: 7310 Empire State Bldg., New York City

ILLCO-WAY
DE-IONIZING
DE-ALKALIZING
SOFTENING

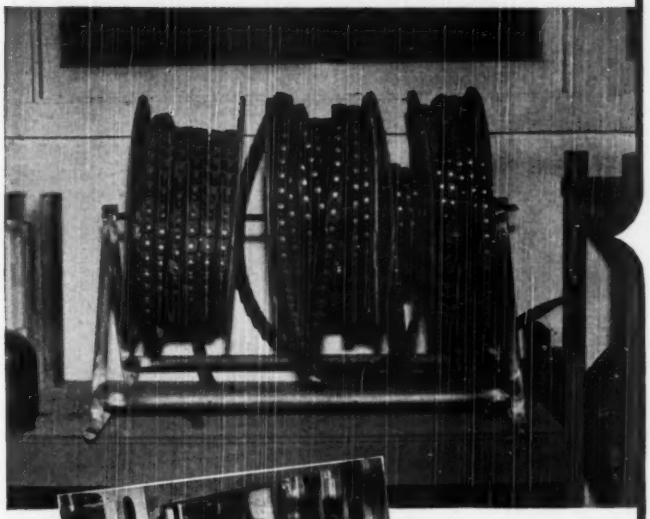
ENGINEERING AND EQUIPMENT—DE-IONIZERS for process water treatment and treatment of liquids and solutions other than water; waste treatment; reclamation of specific constituents. DE-ALKALIZERS: Boiler feed (external); Bottling water. SOFTENERS: Industrial, Domestic. FILTERS, etc.

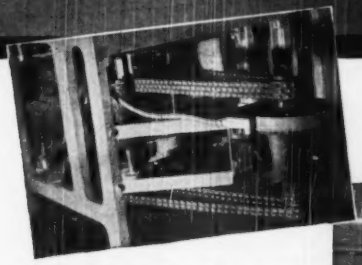
THESE 4 REELS OF VEELOS ARE

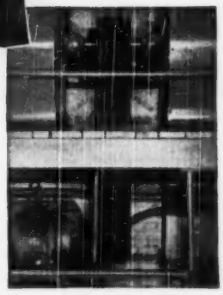
all the v-belt stock

ONE BIG PLANT REQUIRES

1 REEL OF A • 1 REEL OF B • 2 REELS OF C







These drives have been operating for 10 months with Veelos—and still going strong. Endless belt life was 3 months. Veelos installation time was 1 man-hour; endless belt installation time was 30 man-hours. This is one of 12 identical Veelos-driven machines in this plant.

Installation time for Veelos was 1 man-hour—for endless v-belts it was 24 man-hours. These belts have been operating 3½ years. This plant has 3 other Veelos-driven machines exactly like this one.

Before this plant switched to Veelos its stockroom was cluttered with a heavy inventory of different sizes of endless v-belts. This conglomeration of v-belts was expensive to maintain and hard to control.

Now—the story is different! Just 4 reels of Veelos—the adjustable v-belt—take care of 75 v-belt drives in this plant. When the change-over program is completed, all 200 drives will be Veelos equipped!

Naturally enough this plant did not standardize on Veelos without good reasons . . .

- *It saves money* on v-belt inventory—on control of inventory and on storing v-belts.
- *It saves money* when belts are replaced. On one typical installation, a belt change-over that took 30 man-hours—now takes 1 man-hour.
- *It saves money* because Veelos lasts longer—records show they last up to twice as long as endless v-belts.
- *It saves money* because Veelos gives full, vibrationless, power delivery—uniform tension is easily maintained on all belts.

You, too, can *save money*, *boost efficiency*, and *simplify your inventory* by switching to Veelos—the adjustable v-belt.

Have you the facts at your fingertips? Send for your copy of the Veelos Data Book.

MANHEIM MANUFACTURING & BELTING COMPANY
MANHEIM, PA.

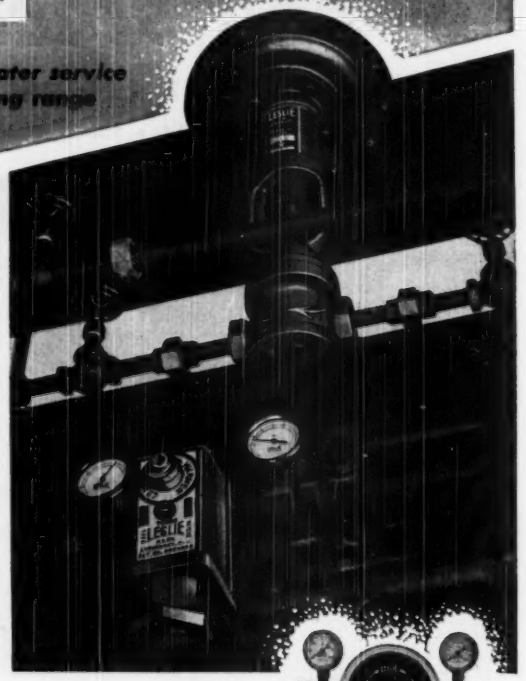
VEELOS
THE LINK
V-BELT

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

Made in all widths in three types: regular, oil-proof and static conducting. Also double V in A and B. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. Veelos is known as VEELINK outside the United States.

Reduce Water Bills and Maintenance Costs with the New TRADE LESLIE MARK THERMOSTAT

Specially designed for cooling water service with greatly increased throttling range



It is a recognized fact that water cooled equipment such as air compressors, diesel engines, etc., perform better and require less maintenance if cooling water temperature is accurately maintained. The importance of cooling water control has become accentuated with the growing need for conserving water. The new LESLIE Thermostat and diaphragm Regulating Valve make an ideal Temperature Controller for economic, reliable control of cooling water.

The bi-metallic Thermostat regulates the flow of water (or air) to the diaphragm of the Regulating Valve to maintain a constant water temperature at the bulb location. A slight temperature change repositions the Regulating Valve and regulates the flow of cooling water.

Features of the New LESLIE Thermostat

THROTTLING RANGE—Wide or narrow throttling range can be furnished with adjustable temperature ranges, 32°—400°F and 300°—600°F.

BI-METALLIC ELEMENT—Expansion or contraction of metallic tube provides positive operating force.

SIMPLE—Few moving parts. Simple pilot valve operates without stuffing box or plunger.

RUGGED, RELIABLE—Wear and corrosion-resistant parts give long life. Accuracy of regulation comparable to instrument control.

For small units requiring only ½ or ¾" cooling water supply use the LESLIE Self-Contained Classes MDR, MCR or MBR Temperature Regulators.

LESLIE Thermostat with calibrated dial for easy adjustment

LESLIE Thermostat with 32°-400°F adjustable range

Lowest Overall Cost per Operating Year

Send For — Bulletin 464-B
"Temperature Regulators and Controllers"

50th Anniversary 1900–1950

Look for LESLIE REGULATORS under "Valves" or "Regulators" in your classified telephone directory in the following cities where LESLIE factory-trained engineers are located.

Albany, N. Y.	Cincinnati, Ohio	Indianapolis, Ind.	Mobile, Ala.	Ponca City, Okla.	Seattle, Wash.
Atlanta, Ga.	Cleveland, Ohio	Kansas City, Mo.	Monroe, La.	Portland, Ore.	Spokane, Wash.
Baltimore, Md.	Denver, Colo.	Kingsport, Tenn.	Montreal, Canada	Providence, R. I.	St. Louis, Mo.
Beaumont, Tex.	Detroit, Mich.	Los Angeles, Calif.	New Orleans, La.	Richmond, Va.	Syracuse, N. Y.
Birmingham, Ala.	Galveston, Tex.	Louisville, Ky.	New York, N. Y.	Rochester, N. Y.	Toronto, Canada
Boston, Mass.	Greensboro, N. C.	Memphis, Tenn.	Orlando, Fla.	Rutherford, N. J.	Vancouver, Canada
Bridgeport, Conn.	Greenville, S. C.	Milwaukee, Wis.	Philadelphia, Pa.	Salt Lake City, Utah	Wilkes-Barre, Pa.
Buffalo, N. Y.	Honolulu, Hawaii	Minneapolis, Minn.	Pittsburgh, Pa.	San Francisco, Calif.	Wilmington, Calif.
Chicago, Ill.	Houston, Texas			Savannah, Ga.	Youngstown, Ohio

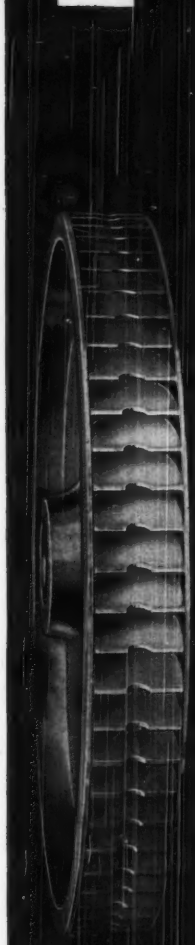
ESTABLISHED 1900

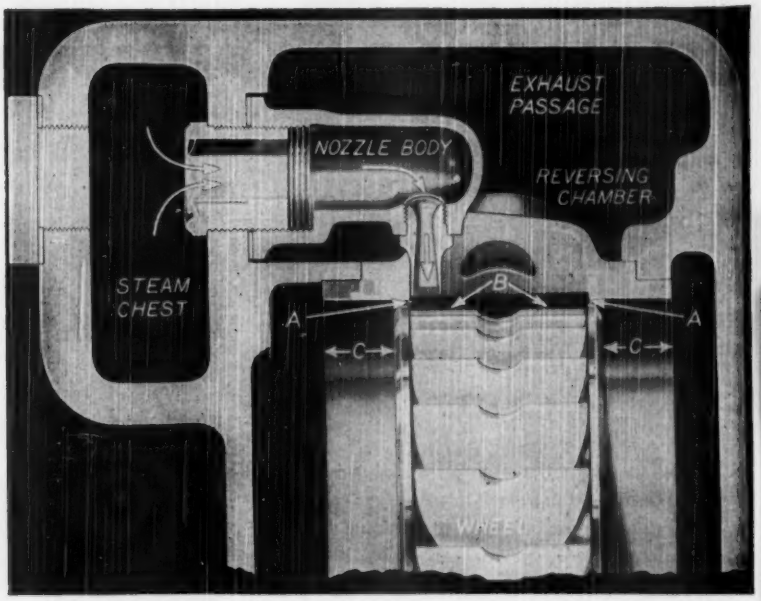
LESLIE CO.

235 Grant Avenue Lyndhurst, New Jersey

FLOATLESS LEVEL CONTROLS • PRESSURE REDUCING VALVES • PRESSURE CONTROLLERS
SELF CLEANING STRAINERS • PUMP GOVERNORS • TEMPERATURE REGULATORS
• AIR HORNS • STEAM WHISTLES

TERRY





AMPLE CLEARANCES FOR DEPENDABILITY

Large blade and rim clearances and extra large side clearance — one inch — help make Terry One-piece Wheel Turbines highly dependable in operation.

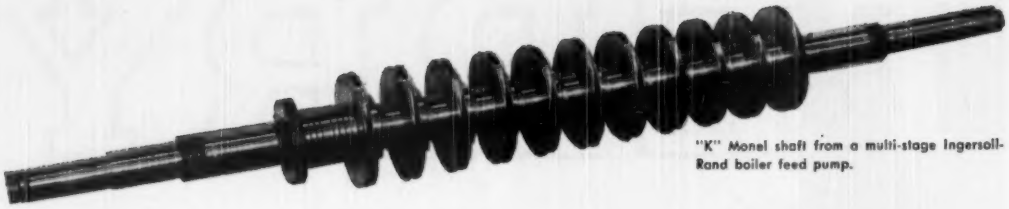
The blades cannot foul because of the protection afforded by the rims, which are not damaged, should rubbing occur.

Note the rim clearance, AA in diagram. Also the large blade clearance, B. Side clearance, CC, is so large that end-play from external thrust cannot damage wheel.

Terry Bulletin S-116 will give you full information on the Terry Wheel Turbine. A request on your business letterhead will bring you a copy.

T-1171

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.



"K" Monel shaft from a multi-stage Ingersoll-Rand boiler feed pump.

"K" MONEL FOR PUMP SHAFTS...

Corrosion-resistant? *Yes!*

Heat-treatable *after* machining? *Yes!*

Strength and hardness close to alloy steel? *Yes!*

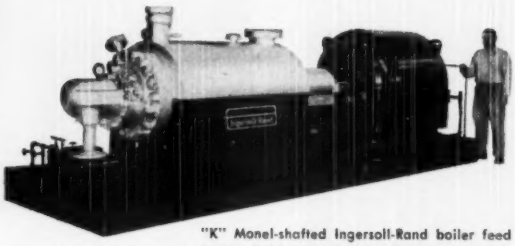
"K" Monel . . . an alloy that may be heat-treated to attain maximum properties . . . has several important qualities that recommend it particularly for pump shafts.

In many pump designs, the shaft must be long and thin, yet capable of withstanding extreme loading as well as highly corrosive conditions. This combination of design factors demands a shaft metal that possesses high strength and hardness, unusually high resistance to corrosion, and high resistance to corrosion-fatigue.

"K"® Monel meets these requirements successfully, and in addition offers the advantage that it may be heat treated for high strength and hardness *after* machining without undue distortion.

Typical installations of "K" Monel-shafted pumps are those of the American Gas and Electric Company System. At three central stations, located in West Virginia and Indiana, a number of Ingersoll-Rand multi-stage pumps are used for boiler feedwater injection.

These pumps operate against a boiler pressure of 2000 psi and higher, and handle water at an average temperature of 304° F. Each pump delivers 1100 gallons per minute at a total dynamic head of 6000 feet.



"K" Monel-shafted Ingersoll-Rand boiler feed pump of the type used by the American Gas and Electric Company System. Manufactured by *Ingersoll-Rand* Company, Phillipsburg, N. J.

These severe conditions demand a shaft metal that is strong, wear-resistant, and corrosion-resistant. Heat-treated "K" Monel has proved entirely satisfactory in this service.

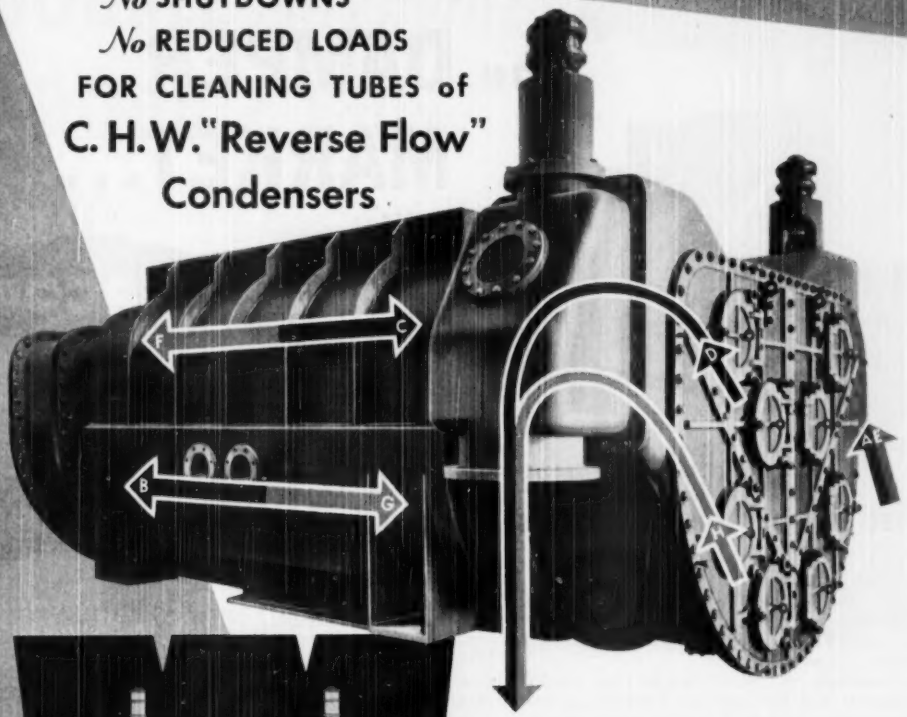
If you are concerned with pump purchase or maintenance, you will be interested in *"How to get longer life from your pumps."* Write to R. F. Johnson of INCO for your free copy.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

EMBLEM OF SERVICE
NICKEL INCO ALLOYS

Monel® • "K"® Monel • "R"® Monel • "KR"® Monel • Nickel
"D"® Nickel • "L"® Nickel • Inconel® • Duranickel®
Permanickel® • Inconel "X"®

No SHUTDOWNS
No REDUCED LOADS
FOR CLEANING TUBES of
C. H. W. "Reverse Flow" Condensers



In the normal operation of a C. H. W. "Reverse Flow" Condenser, as shown in photograph, the lower half of the water inlet valve and the upper half of the discharge outlet valve are open and water follows path of black arrows (A-B-C-D). For flushing, these valves are closed, and the other valves opened; flow reverses, and water follows course indicated by gray arrows (E-F-G-H), as shown in side view. Note that piping to and from the water box is as simple as with a standard condenser.

Tubes of any condenser can become clogged with sand, leaves, twigs and other debris that gets by water screens. This means a cleaning job has to be done. For condensers with undivided water boxes, it means frequent shutdowns and, for divided water box condensers, it means operating at a reduced load. But that's not the case with C. H. W. "Reverse Flow" Condensers. All you do is push a button and reverse the water flow which flushes out debris quickly and economically. Consequently, you get the economies of continuous, peak-load efficiency and virtually eliminate costs of cleaning clogged tubes. "Reverse Flow" savings are available for any size condenser, the smallest now operating being 10,000 sq. ft. and the largest, 50,000 sq. ft. YES, there'll be NO shutdowns or operating at reduced loads if you use C. H. W. "Reverse Flow" Condensers. Write for more information.

C. H. WHEELER MANUFACTURING CO.
1800 Sedgley Ave., Philadelphia 32, Pa.
REPRESENTATIVES IN MOST PRINCIPAL CITIES

C. H. Wheeler OF PHILADELPHIA
STEAM CONDENSERS · WATER COOLING TOWERS
EJECTORS · STEAM JET VACUUM REFRIGERATION
SINCE 1903

We're not out to corner the DAMPER MARKET...

. . . we want HEACON DAMPER applications that will pay for themselves in 6 months.

The Heacon Damper is not just *another* damper. It is designed and engineered to provide the tightest closure possible under all conditions. Each damper is developed to solve a specific problem, each provides the ultimate in control.

The dampers shown on this page all solved specific problems that could have been solved in no other way.

As an example, the second damper from the left above, not only controls 80" w.g. pressure, but also acts as an automatic reverse flow valve that instantly closes and prevents leakage should one of two fans on the boiler fail. The next damper on the right isolates its air heater for maintenance while the boiler continues in service. Such applications save many times their cost, in time and power loss.

Call or write the office nearest you for full details.

THE THERMIX CORPORATION
GREENWICH, CONN.

Canadian Affiliates: T. C. CHOWN, LTD.,
1440 St. Catherine St. W., Montreal 25, Quebec

FIELD REPRESENTATIVES

ATLANTA 3, GEORGIA
C. E. Johnson & Associate,
404 Bona Allen Building

BOSTON 16, MASS.
Holbrook & Hunter, 88 Broad St.

BUFFALO 13, NEW YORK
The Johnston Engineering Co.,
1200 Niagara Street

CHARLOTTE 2, N. C.
T. C. Heyward,
1408 Independence Building

CHATTANOOGA 2, TENN
Edgar A. Rogers,
Chattanooga Bank Building

CHICAGO 6, ILLINOIS
Cochrane Engineering Corp.,
309 West Jackson Blvd

CINCINNATI 2, OHIO
Ellman Equipment Co.,
1101 Federal Res. Bank Bldg.

CLEVELAND 15, OHIO
The H. W. Kaiser Company,
1836 Euclid Avenue

DETROIT 2, MICHIGAN
Metrol Company, 5538 Cass Ave.

HOUSTON 1, TEXAS
The J. A. Rossiter Company,
P. O. Box 1095

KALAMAZOO, MICH.
Metrol Company,
420 W. South Street

KANSAS CITY 6, MO.
The Hosler Co., 950 Dierks Bldg.

LOS ANGELES 7, CALIF.
Southport Eng. Co.,
235 W. 32nd St.

MINNEAPOLIS 4, MINN.
Hoyt A. Sevey, 1525 S. 5th St.

NEW HAVEN 5, CONN.
Daniel Smerling,
P. O. Box No. 1169

NEW ORLEANS, LA.
Arlenco Company, Inc.,
1221 Carondelet Building

NEW YORK 7, N. Y.
Parry Eng. Co.,
154 Nassau St.

PHILADELPHIA 3, PA.
Thermix Engineering Co.,
1003 Broad St. Station Bldg.

PITTSBURGH 19, PA.
Herr-Harris Company,
545 William Penn Place

RICHMOND 1, VA.
Frank Howell Company,
Room 412, American Bldg.

ROCHESTER 4, N. Y.
The Johnston Engineering Co.,
31 Gibbs Street

SALT LAKE CITY 9, UTAH
The Lang Company,
267 West First South St.
P. O. Box 479

SAN FRANCISCO 4, CALIF.
The Fulcher Company,
58 Sutter Street

SEATTLE 4, WASH.
Lee & Freeman, Inc.
219 Central Bldg.

SCHENECTADY, N. Y.
D. R. Whipple, 6 Morris Ave.

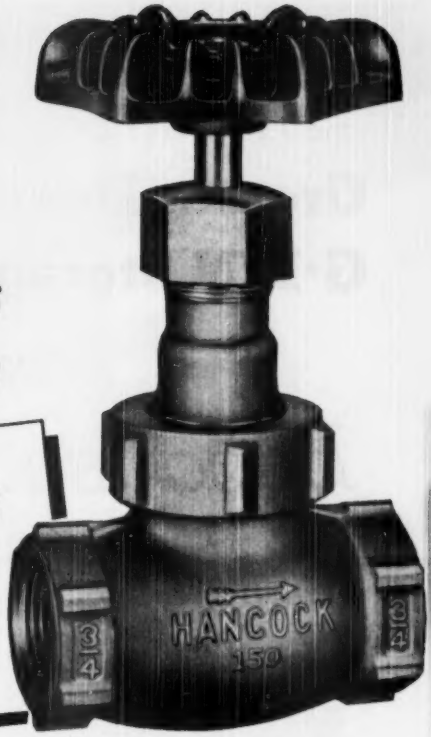
ST. LOUIS 8, MISSOURI
Economy Equipment Co.,
4526 Olive Street

TOLEDO 4, OHIO
Metrol Company,
518 Jefferson Avenue

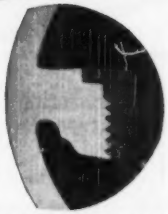
WASHINGTON 6, D. C.
T. W. McGuire Company,
1627 K Street, N. W.

DOUBLE *Strength!*
DOUBLE *Value!*

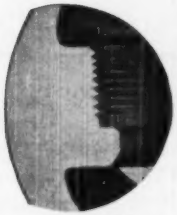
300# *valve qualities*
150# *valve prices*



The New 150# Hancock "500 Brinell" Bronze Valve



USUAL BRONZE VALVE DIAPHRAGM



HANCOCK DIAPHRAGM

Diaphragm construction of the new 150# Hancock Bronze Valve is *125% to 230% stronger* than found in usual bronze valves.

Here's the bronze valve for greatest service, greatest savings.

Note, for example, the diaphragm construction equal to that of a 300# bronze valve—for strength, rigidity, freedom from leaks, long service life.

Add the fact that the "500 Brinell" stainless steel seats and discs—near diamond-hard—eliminate wire drawing, steam cutting, erosion and corrosion and you'll have the reasons why maintenance is cut to a minimum.

These new valves are super tough! They really stand up to the hardest installation and piping strains, expansion in piping systems.

Before you specify, compare the new 150# Hancock Bronze valve *with any other make*. You're sure of *double savings* if you do.

New 150# Hancock Bronze Valves are available at your local Hancock distributor

MAXWELL MANNING M&M & MOORE INC. TRADE MARK

HANCOCK *Valves*

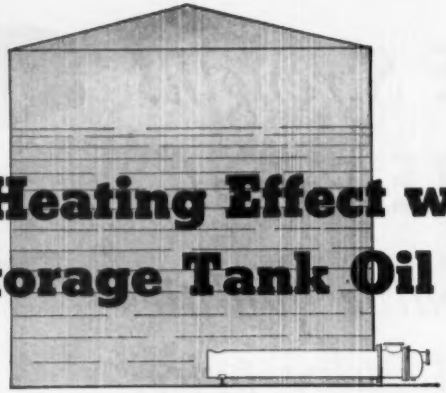
1877 HANCOCK U.S.A.

A PRODUCT OF

MANNING, MAXWELL & MOORE, INC.

WATERTOWN 72, MASSACHUSETTS

Makers of 'Hancock' Valves, 'Ashcroft' Gauges, 'Consolidated' Safety and Relief Valves, 'American' Industrial and 'Microsen' Electrical Instruments. Builders of 'Shaw-Box' Cranes, 'Budgit' and 'Load-Lifter' Hoists and other lifting specialties.

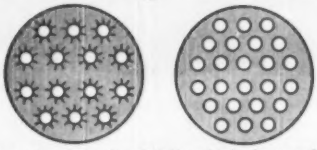


Greater Heating Effect with the G·FIN Storage Tank Oil Heater

because....

1.

Greater Access of Oil to Heating Elements



At left is a tube sheet of a G-R finned-tube heat exchanger. At right is a tube sheet of a typical bare-tube heat exchanger. Note the greater access space between tubes in the G-R exchanger.

2.

Greater Heating Surface of G·FIN Elements

Even in sub-zero temperatures, the G-R G-Fin Storage Tank Oil Heater assures a steady flow of oil soon after the steam is turned on. That's because (1) the wider tube spacing allows the viscous oil greater access to the tubes than in a conventional heater and (2) the G-Fin elements provide six to eight times the heating surface of bare tubes.

Greater heating effectiveness is only one of the important reasons why users prefer the G-R G-Fin Storage Tank Oil Heater. These units use less steam because they heat oil only locally at point of withdrawal. The straight-through flow of oil results in minimum pressure drop. There's no stratification or vapor binding because the oil outlet is located at the top of the shell. And there are fewer tubes and tube joints to maintain.

These and other advantages of the G-Fin Storage Tank Oil Heater have been fully proved in thousands of installations. Write for Bulletin 1642 describing these units in detail.

TYPICAL APPLICATIONS OF G-R G-FIN STORAGE TANK OIL HEATER

STORAGE TANKS—containing heavy oils, tar or asphalt at refineries, tank farms, etc.

SERVICE TANKS—serving oil-burning boilers at central power stations, industrial plants.

LOADING WHARVES—to speed up transfer of oil to and from tanks, lighters, barges or cars.

CHEMICAL PLANTS—wherever viscous oil or other liquids must be transferred in bulk.

GAS PLANTS—where by-product tar or heavy oils must be heated.

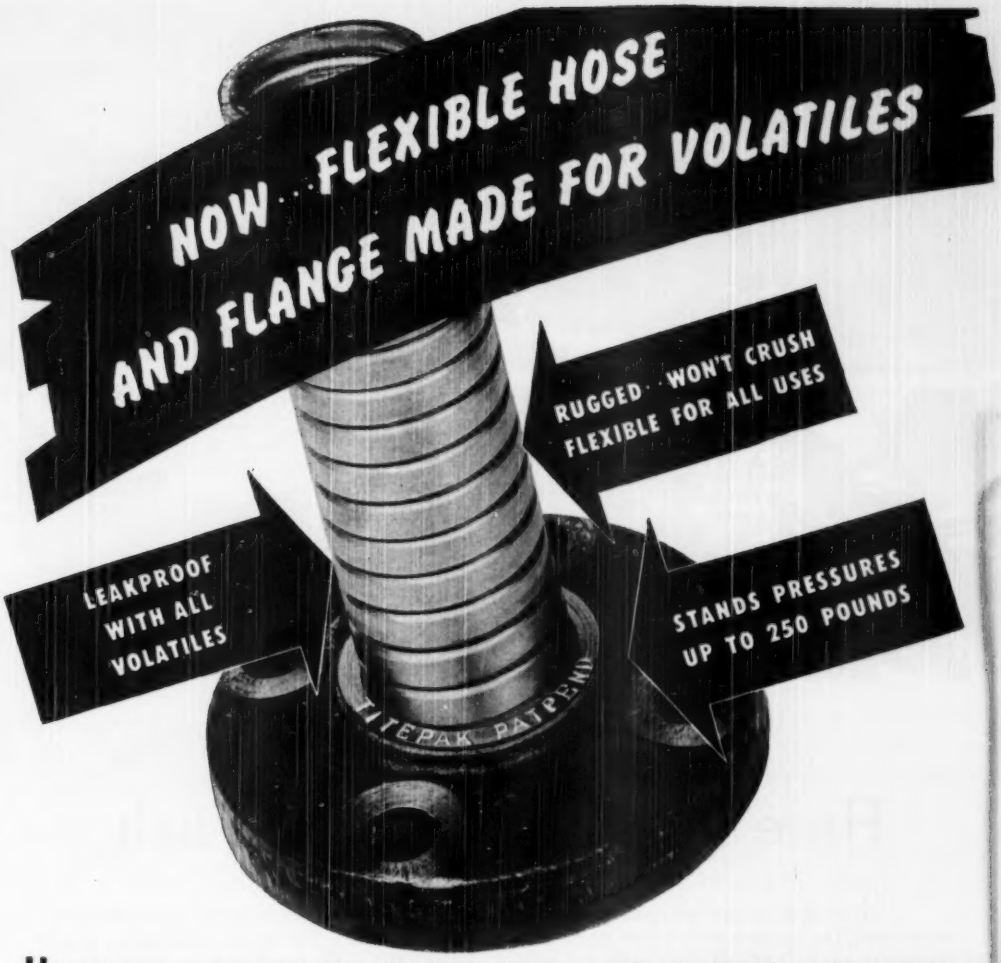
MISCELLANEOUS—for heating cottonseed oil, molasses, road oil and other viscous liquids.

THE GRISCOM-RUSSELL CO., 285 MADISON AVENUE, NEW YORK 17, N. Y.

GR-223

GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS



Here's the hose and flange that will handle highly volatile liquids . . . will not leak . . . yet is rugged . . . tough . . . and flexible.

Developed especially for the petroleum and chemical industries, this new Penflex hose has been tested and performance-proved. It will withstand pressures up to 250 pounds and has proved its value in conveying oil, gasoline, kerosene and other volatiles. Available in sizes 2½" to 12" I.D.

The new Penflex Titepak Flange completes this leakproof assembly. It is leakproof under all conditions . . . lighter in weight than other types of flanges . . . and is much lower in price. Penflex Titepak Flange assures greater efficiency in handling volatiles . . . lasts longer . . . is more rugged . . . and is tamperproof.

Penflex manufactures a complete line of four wall interlocked and seamless welded corrugated flexible tubing for the power industry . . . automatic barrel fillers . . . pneumatic rivet passers . . . and accessories and fittings. To cut your maintenance, write for your copy of "Flexineering at Work."

PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.

7238 Powers Lane **Philadelphia 42, Pa.**

Branch Sales Offices—BOSTON • NEW YORK • CLEVELAND • CHICAGO • HOUSTON • LOS ANGELES

Penflex... HEART OF INDUSTRY'S LIFE LINES

Here's a pretty kettle of fish

SURVEYS reveal an appalling misunderstanding among young people of the "facts of business life". For example, a poll was made among seniors in certain high schools which showed that they believe business profits are "over 50%", where actually profits average less than 8%.

They think that stockholders receive 24% on their investments, where actually it runs less than 3%.

Isn't this a pretty kettle of fish?

Such ignorance is alarming. It is unfair to the young people themselves and dangerous to America's future. Such misconceptions open the door to socialism, communism and all the fantasies of the handout or "something-for-nothing" state.

Our school teachers say they *want* authentic information on the business system and how it works. Only business itself can supply the facts. You as a business leader in your community must share the responsibility for this misunderstanding. It is our civic duty to help overcome this misconception of everyday economics in the minds of our youth today.

THE YOUNGSTOWN SHEET & TUBE CO. 1900 YOUNGSTOWN 1950 50 YEARS OF SERVICE

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

ELECTROLYTIC TIN PLATE - COKE TIN PLATE - WIRE - COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - CONDUIT - RODS - SHEETS - PLATES - BARS - RAILROAD TRACK SPIKES.

Zallea Expansion Joint News

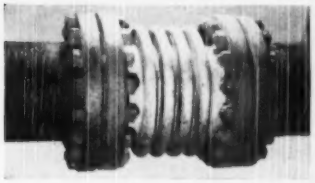
PUBLISHED BY ZALLEA BROTHERS—WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY

Expansion Joint of the Month

Why Zallea Joints Last Longer

WHEN THE "HEAT'S ON"

Over six years ago a large oil refinery installed 39 non-equalizing expansion joints in its reactor piping. Within six months these joints failed . . . unable to withstand the terrific punishment of 1125° F. vapor temperatures. These were replaced by Zallea Expansion Joints. Today, over 5½ years later, these Zallea Expansion Joints, one of which is shown here in an unretouched photo, are giving trouble-free performance. Actually, both joints look alike . . . same alloy steel, same physical appearance.



But that's where similarity ends. The difference lies in the *control* exercised in every step of the manufacturing process of Zallea Expansion Joints. It's that *control* that makes Zallea the ideal joint for absorbing contraction and expansion of pipe lines due to temperature changes. Be *sure* of trouble-free operation in *your* plant . . . always specify ZALLEA.

. . . a complete, practical catalog on all Zallea Expansion Joints. A text book and a valuable reference source. Send for your *free* copy *today!*

ZALLEA BROTHERS, 814 Locust Street
Wilmington 99, Delaware

CONTROLLED WELDING ASSURES LONGER EXPANSION JOINT LIFE

In a corrugated expansion joint, the deflection stress varies directly as the bellows thickness. And, the life of a corrugated expansion joint varies as the cube of the bellows thickness. Therefore it is essential that the corrugated bellows have a uniform thickness throughout. Only in Zallea Stainless Steel Expansion Joints are you assured of this optimum condition because Zallea alone produces a longitudinal weld of the same thickness as the parent metal.

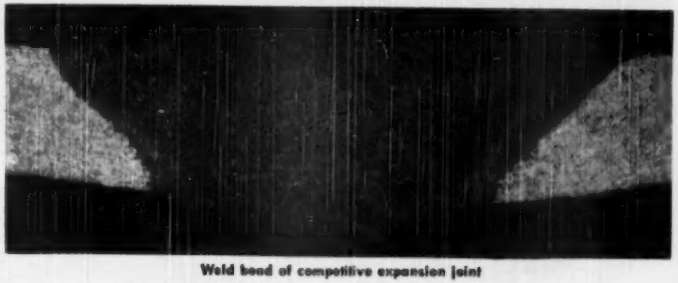
Welding Methods Tested

Accelerated flexing tests of corrugated bellows proved that the resultant welding bead of a shielded arc weld was detrimental to the life of the bellows because failure always occurred across the weld —thickest section of the bellows. Zallea metallurgists, after analyzing the many known welding processes, found that by adopting an exclusive variation of the Heliarc process and adding a grain refining procedure to the finished weld, they could produce a corrugated bellows that under accelerated flexing tests *failed in the parent metal only.*

Longer Life Assured

In over 100 bellows tested with Zallea *controlled* welding, not one failure occurred within 30 degrees of the weld line. More important was the fact that these bellows lasted four to eight times longer than bellows having a shielded arc welding bead. The two unretouched photomacrographs below illustrate the exclusive Zallea *controlled* welding technique as compared to the welding procedure used in other expansion joints. When you want the best in stainless steel expansion joints, always specify ZALLEA . . . you'll find it pays!

Weld bead of Zallea Expansion Joints ***(Compare fine grain of weld with illustration below)***

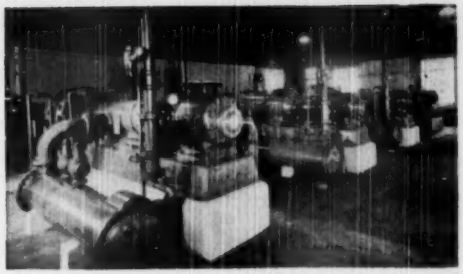


Weld bead of competitive expansion joint

(Advertisement)

NAVCO
PROVIDES THE
POWER ARTERIES
IN THIS
CENTRAL STATION
Just another modern High Pressure-High Temperature Power Plant in the Southwest that has DEPENDABLE Piping.
NAVCO
NAVCO PIPING
NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.
NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • TULSA • BUFFALO • CINCINNATI

FULLER ROTARY COMPRESSORS



Four Fuller Rotary Two-stage Compressors installed in a steel mill. Capacity each, 1665 c.f.m., 100-lb. pressure.

Facts

that prove our case!

• • • FULLER ROTARY COMPRESSORS *are built for* 100-125-LB. PRESSURE

Many users of compressed air, we find, are laboring under the false impression that Fuller Rotary Compressors are built only for low-pressure operation. To refute this impression, we list below, only a few cases in the steel industry, which show installations of two-stage machines, operating at high pressures.

	TOTAL FULLER ROTARIES PURCHASED	FOR HIGH-PRESSURE OPERATION
Company A	8	6
" B	6	5
" C	4	4
" D	28	23
" E	7	6
" F	21	21
" G	5	5
" H	4	4
" I	17	11
" J	19	18

The next time you are in the market for compressors, or vacuum pumps, may we have the opportunity to tell you more about Fuller Rotaries?

FULLER COMPANY

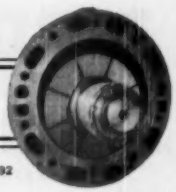
CATASAUQUA—PENNSYLVANIA

Chicago 3 - 120 So. LaSalle St.

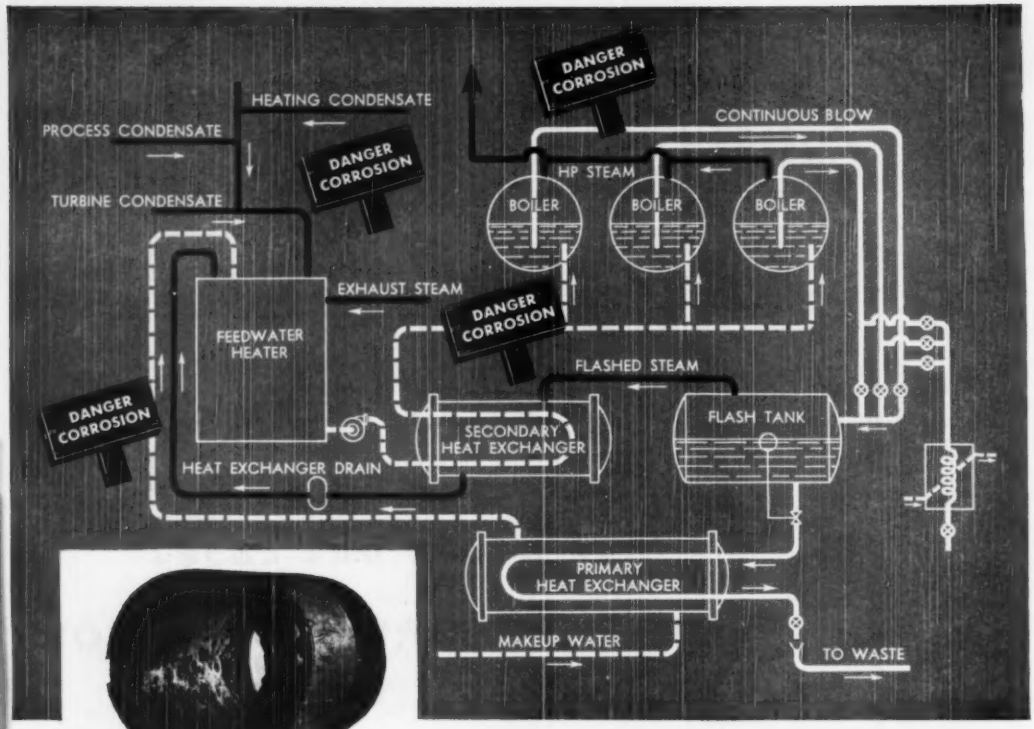
San Francisco 4 - 420 Chancery Bldg.

No. 2 of a series

A LIFETIME OF NEW MACHINE EFFICIENCY



C-192



AVOID These Danger Signs with BIRD-ARCHER Amine Treatment

CORRODED condensate return lines lead to expensive pipe replacement and maintenance. As an added annoyance, the solid products of corrosion often plug return lines and fill traps. You can steer clear of these troubles by using the *effective, economical* Bird-Archer Amine Treatment.

HERE'S THE WAY THIS B-A TREATMENT WORKS

Amines are fed into the boiler or into the steam and condensate systems. The amines raise the pH value of the condensate and also tend to inhibit equipment-destroying corrosion through surface protection of the metal itself.

HERE'S HOW THIS B-A TREATMENT SAVES MONEY

Raising the pH value of the condensate severely decreases maintenance costs by eliminating corrosion. These savings may more than offset the amount of treatment required to provide protection for your equipment.

NEW BULLETIN gives full details on the Bird-Archer Amine Treatment. . . . contains case histories that prove its successful application in many plants. *Write for your copy today.*

BA-154

WHAT AMINES ARE

Amines are members of a class of chemical compounds in which one or more hydrogen atoms of the ammonia molecule are substituted by an organic group. Some of the simpler types are soluble and volatilize from boiler waters. The alkalinity of the amines is an inherent property and does not result from decomposition. *No free ammonia is released.* In the concentrations necessary for protection of condensate systems, amines are harmless to non-ferrous metals, non-toxic and are completely stable at temperatures approximating 675F.

BIRD-ARCHER
WATER TREATMENT

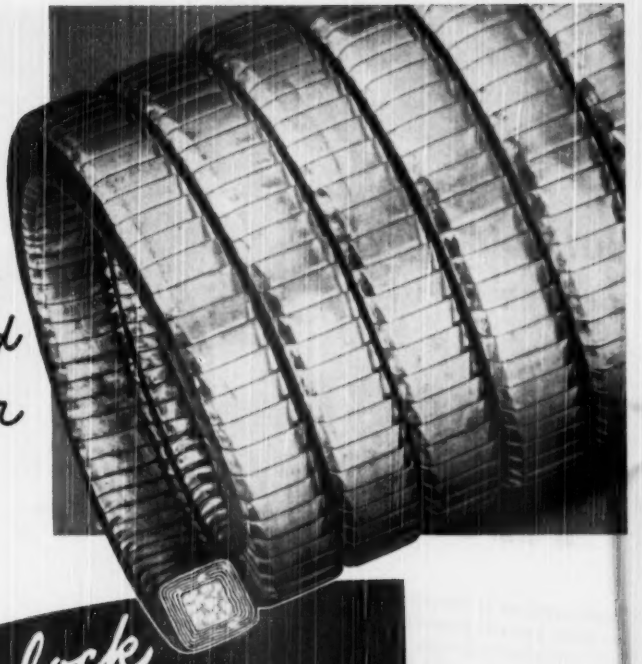
THE BIRD-ARCHER COMPANY, 400 MADISON AVE., NEW YORK 17, N. Y.

Philadelphia, Pennsylvania • Chicago, Illinois • Montreal, Canada

CALDERAS Y ACCESORIOS, S. A. AMSTERDAM 291, MEXICO, D. F.

QUESTION:

What packings are resilient and flexible, but wear like metal?



ANSWER:

Garlock METAL FOIL Packings

COPPER GARLOCK 906—Pleated copper foil with asbestos core for steam, air or gases (except ammonia) and hot oils of low sulphur content, at temperatures up to 1000° F.

ALUMINUM GARLOCK 913—Pleated aluminum foil with asbestos core for hot oils at temperatures up to 1000° F.

LEAD GARLOCK 917—Pleated lead foil with asbestos core for steam, air, oil, water, ammonia or other gases at temperatures up to 550° F.

GARLOCK Metal Foil Packings are constructed of thin metal foil spirally wrapped around a fibrous center core. The durability of metal wearing surfaces in contact with the rod or shaft is thereby combined with the resiliency of a fibrous packing.

A patented, pleated foil construction used in several of these new Garlock packings imparts unusual flexibility to the packing and permits the forming of rings without undue distortion of the material. GARLOCK Metal Foil Packings are recommended for centrifugal or reciprocating pumps, compressors, engines, expansion joints, etc. Write for descriptive folder.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

GARLOCK

PACKINGS, GASKETS AND OIL SEALS

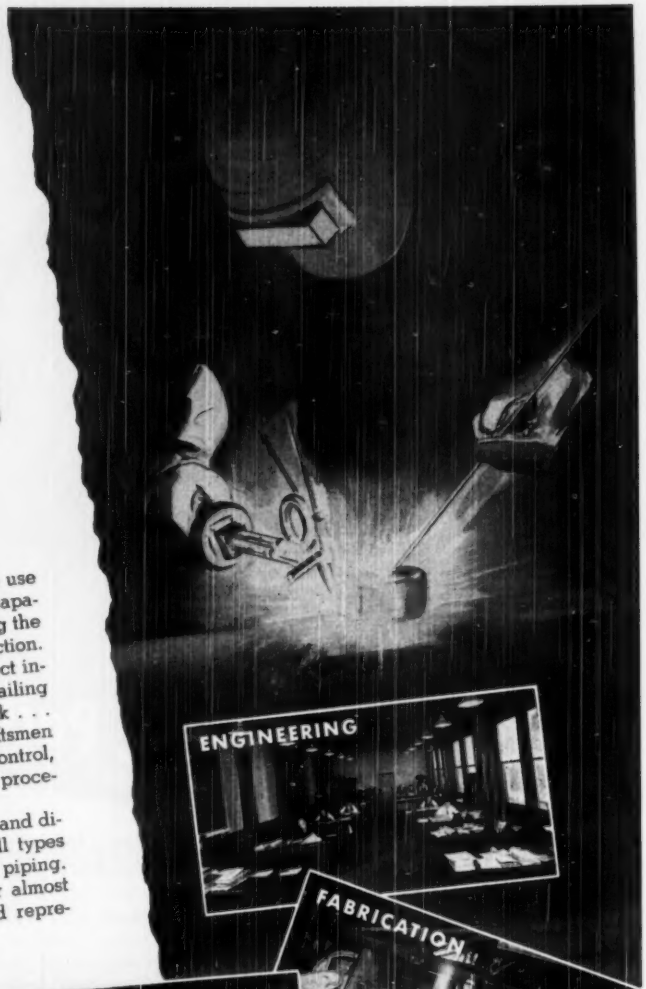
PUT YOUR COMPLETE
POWER PIPING JOB
IN

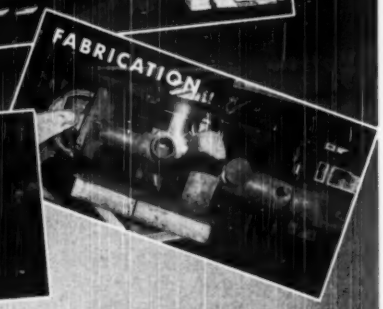
CAPABLE HANDS

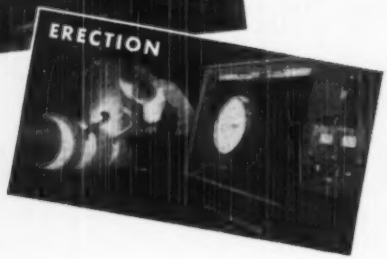
Prefabrication is the accepted method to use on today's power piping job. And it takes capable hands to do the job—every step along the way from engineering through field erection.

Efficient prefabrication requires correct interpretation of blueprints . . . careful detailing to coordinate shop work with field work . . . complete shop facilities and trained craftsmen . . . highly specialized metallurgical control, model testing, and other accepted test procedures . . . and expert field erection.

Equally important—it requires long and diversified practical experience with all types of high pressure, high temperature piping. We have specialized in this field for almost half a century. Ask our nearest field representative for additional information.







Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Whitehead Building, Atlanta
Book Tower, Detroit
525 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston

APARTMENT FOR SLIME

With condenser tubes handling unchlorinated water, slime-forming bacteria never have to worry about a housing shortage. Instead, these bacteria move in, form their colonies, and the condenser tubes become apartments for slime. When this happens, the terminal log mean temperature difference rises, excess steam costs go up, and outage increases along with the labor bill for costly plug cleaning.

Chlorination, engineered by W&T and backed by 35 years' experience, has proven itself the effective answer to slime in condenser and heat exchanging equipment. It is effective because the Wallace & Tiernan De-Sliming Process attacks the cause of slime, bacteria, and "evicts" these unwanted "tenants" from their home in your equipment.

CD-33

Regardless of whether yours is an open or closed cooling system or whether you use shell and tube, trombone, or open box condensers, Wallace & Tiernan engineering plus time-tested W&T Chlorinators can put all the money-saving advantages of slime control by chlorination to work on your condensers or heat exchange equipment.

Write today for complete information.

WALLACE & TIERNAN PRODUCTS, INC.

CHLORINE AND CHEMICAL CONTROL EQUIPMENT

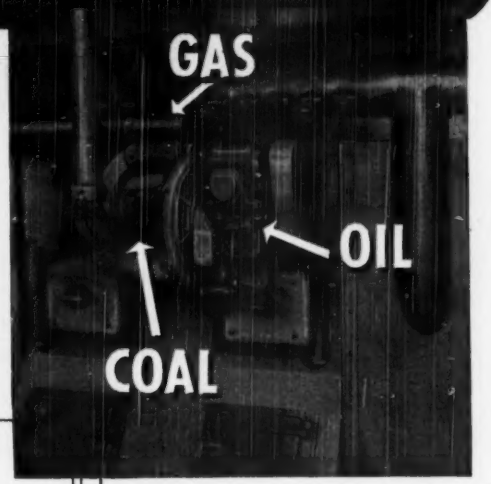
Belleville 9, New Jersey • Represented in Principal Cities

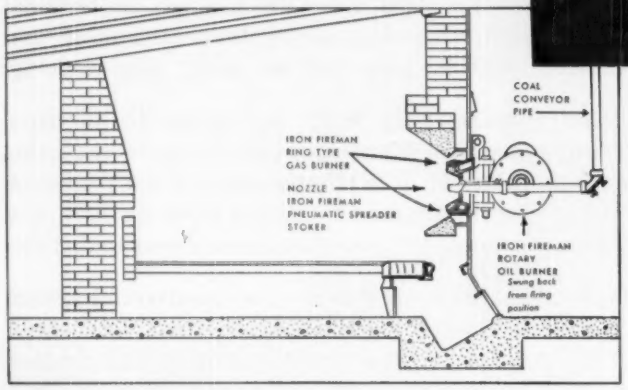
Iron Fireman Fires GAS, OIL or COAL in the same boiler

Switch fuels quickly

Guard your plant or buildings against possible fuel shortages. Protect yourself against high fuel costs. Equip your boilers to burn whichever fuel is lowest in cost or most readily available.

Iron Fireman builds and installs highly efficient automatic firing equipment for coal, oil or gas. It has also developed combination units for firing any two of these fuels—or all three—with quick changeover from one fuel to another.




COAL CONVEYOR PIPE
IRON FIREMAN RING TYPE GAS BURNER
NOZZLE IRON FIREMAN PNEUMATIC SPREADER STOKER
IRON FIREMAN ROTARY OIL BURNER
Swung back from firing position

Shown above is boiler front equipped for firing with coal, oil or gas. The Iron Fireman Pneumatic Spreader stoker delivers coal from hopper or from main coal bunker by pneumatic conveyor, and conveyor nozzle (shown here in firing position) accurately spreads the larger particles of coal over the entire grate in a shallow, uniform fuel bed. Preheated fines burn in suspension. For oil firing coal nozzle is withdrawn and Iron Fireman Rotary oil burner (for No. 6 oils or lighter) is swung into firing position. For gas firing the Iron Fireman Ring Type gas burner is used, in which stainless steel gas jets surround the firing port. In an emergency the fuel change can be accomplished in a few minutes.

Diagram at left shows three-fuel installation in straight tube boiler.

In many applications the Iron Fireman underfeed stoker can also be used in conjunction with the Iron Fireman gas-coal combination burner.

Iron Fireman engineers will gladly make a free survey of your boiler plant, and give you an estimate on firing equipment that will pay you new profits as well as insure you against losses due to changes in fuel prices and availability.

Write for illustrated folder to Iron Fireman Mfg. Co., 3234 West 106th St., Cleveland 11, Ohio. Plants in Cleveland; Portland, Oregon; Toronto, Canada. Sales, service and engineering organization covers the United States and Canada.

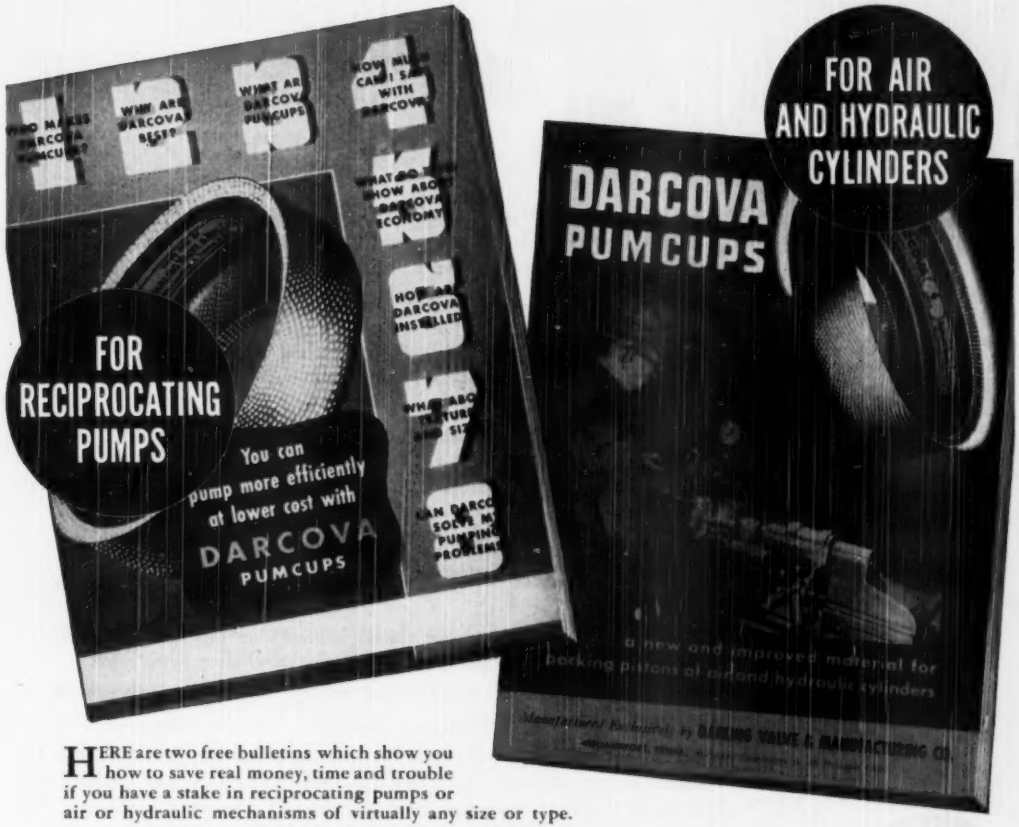
THE IRON FIREMAN

IRON FIREMAN

AUTOMATIC HEATING WITH GAS, OIL, COAL

RECOMMENDED READING

ON REDUCING PISTON-PACKING COSTS AND CUTTING OVER-ALL OPERATING EXPENSE!


FOR RECIPROCATING PUMPS
You can pump more efficiently at lower cost with
DARCOVA
PUMCUPS
FOR AIR AND HYDRAULIC CYLINDERS
DARCOVA
PUMCUPS
a new and improved material for packing pistons of compound hydraulic cylinders

HERE are two free bulletins which show you how to save real money, time and trouble if you have a stake in reciprocating pumps or air or hydraulic mechanisms of virtually any size or type.

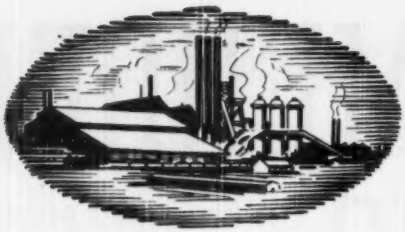
These bulletins explain clearly how Darcova Pumcups work . . . and are full of engineering data and typical performance examples. There's plenty of information to enable you to judge how much you stand to gain by giving Darcova Pumcups and Darling pistons a try. Write, or use the handy coupon below.

DARCOVA
THE ORIGINAL COMPOSITION CUP

DARLING VALVE & Manufacturing Co.
WILLIAMSPORT, PA.

Darling Valve & Mfg. Co., Williamsport 8, Pa.
Please send me the free bulletin checked below:
☐ No. 4401 Darcova Pumcups for reciprocating pumps.
☐ No. 4502 Darcova Pumcups for air or hydraulic mechanisms.

Name_____
Company_____
Address_____
City_____ State_____



1900 ★ THE MIRACLE OF AMERICA ★ 1950

Freedom and Progress

It's no stretch of the imagination, rather, robust realism to call our past half century a Miracle—U. S. A.

America has set an amazing record of progress in 50 years—but a moment in the history of civilization. A record unequalled by any other political or economic system.

Merely by broad brush strokes, we can all visualize this miracle. Remember the crystal set, the hand-cranked car, the biplane? A far cry from our FM radio, television, hydro-matic drive and supersonic planes.

And here's another phase of the miracle that went hand-in-hand with these and the myriad of intertwined technological advances—ranging from the radio telephone and Bakelite to the X-ray tube and teletype . . . and to atomic energy and its untold potentialities.

- ☆ Since 1900 we have increased our supply of machine power 4½ times.
- ☆ Since 1900 we have more than doubled the output each of us produces for every hour we work.
- ☆ Since 1900 we have increased our annual income from less than $2400 per household to about $4000 (in dollars of the same purchasing power), yet . . .
- ☆ Since 1900 we have cut 18 hours from our average work week—equivalent to two present average workdays.

How did we do it? The basic cause for this composite miracle has been the release of human energy through FREEDOM, COMPETITION and OPPORTUNITY. And one of the most important results is the fact that more people are able to enjoy the products of this free energy than in any other system the world has ever known.

A PUBLIC SERVICE PROJECT THE ADVERTISING COUNCIL

THIS IS THE MIRACLE OF AMERICA . . . it's only beginning to unfold.

Published in the public interest by:

McGraw-Hill Publications

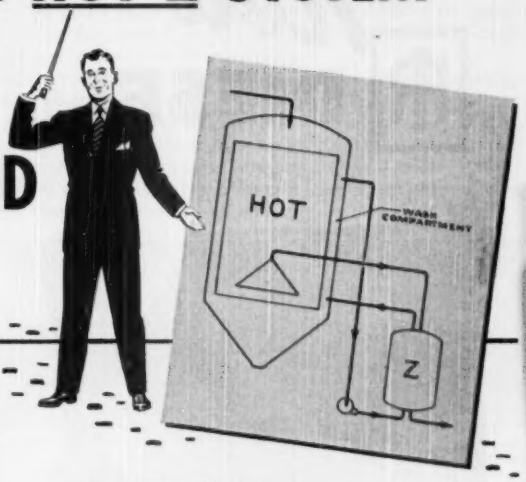
REVOLUTIONARY

advance in boiler feed water treatment!

WORTHINGTON HOT-Z SYSTEM

combines all the best features of

HOT PROCESS AND ZEOLITE



Choosing between Hot Process and Zeolite is no longer a boiler feed water problem. The Worthington Hot-Z System gives you the advantages of each system including deaeration.

SEE WHAT HOT-Z DOES FOR YOU:

1. Reduces hardness to 0.2 ppm without addition of excess soda alkalinity.
2. Operates on cheapest chemicals — lime and salt.
3. Saves enough in chemical costs to pay for average installation in 3 years.
4. Offers easy control when operating on variable waters.
5. Removes oxygen to 0.005 cc per litre.
6. Makes cumbersome two-tank lime-soda-phosphate systems obsolete.
7. Includes ideal facilities for the necessary hot clear water zeolite washing process.
8. Makes filters unnecessary except in special cases.
9. Does away with vent condenser scale.
10. Reduces phosphate precipitates in boiler to unobjectionable amount.
11. Reduces silica.

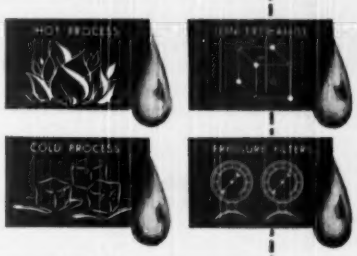
INVESTIGATE! If you are now considering split treatment, hold up your decision until you examine the Worthington Hot-Z System. Tell us your conditions of service and get our recommendation in terms of dollars and benefits. You'll find in our Hot-Z System, as in so much other equipment, *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Water Treating Division, Dunellen, N. J.*

J-9-4

WORTHINGTON

WATER CONDITIONING

Worthington Makes More of the Equipment for All Types of Water Conditioning Systems



Only the *New* IR DIESEL

195 to 375 horsepower

. . . gives

big-engine features in a small package

Here's the smaller, lighter, more efficient, 4-cycle, supercharged heavy-duty diesel you've been waiting for . . . the TS engine. It's portable . . . but not automotive. Weighs only 30 lb per hp . . . yet operates at 900 to 1000 rpm. Consumes only 0.40 lb of fuel per hp-hr . . . yet has small, 7" by 8½" cylinders. Perfect balance . . . but no balancing devices.

Compare the new Ingersoll-Rand TS with any other diesel for size, economy; and performance—and you'll agree it is the greatest advance in engine design in the past decade. Ideal for cranes, shovels, derricks, pumps, generators, and all types of stationary and portable applications. Send for complete information today.

Ingersoll-Rand

11 Broadway, New York 4, N. Y.

523-7

D-F S-E*

*EXPANSION JOINTS

The importance of D-F S-E to you may be measured in dollars. Maintenance costs are reduced to a minimum. Initial cost is amortized over a long life. Case histories show BADGER D-F S-E EXPANSION JOINTS installed in the early thirties are still on the job.

D-F S-E could mean *definite financial savings effected* —actually D-F S-E does mean **Directed-Flexing Self-Equalizing.* Directed-Flexing, an exclusive construction feature in Badger Joints, is a combination of an all-curve corrugated member and correspondingly shaped Self-Equalizing rings which not only limits the movement of each corrugation but also progressively controls each increment of movement over the area of each corrugation. This construction eliminates localized stresses which cause metal fatigue and break-downs.

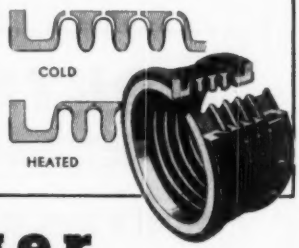
Send today for new 24-page catalog

All-curve flexing guarantees longer life

Badger Joints flex like this . . .

not like this . . .

. . . this stress-free flexing principle exclusive with Badger

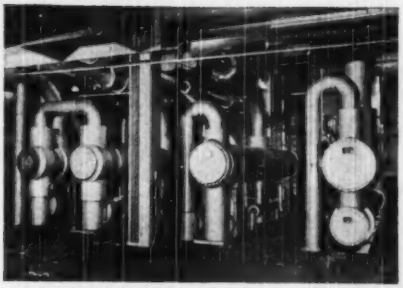


Badger

MANUFACTURING COMPANY

230-260 BENT STREET CAMBRIDGE 41, MASS.

five examples of EFFICIENT HEAT TRANSFER EQUIPMENT

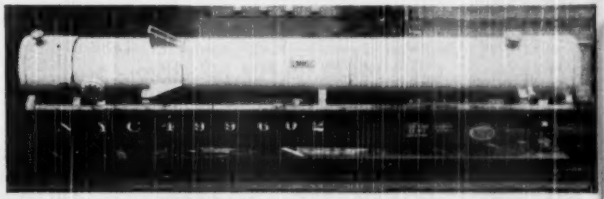


LUMMUS FEED WATER HEATERS and HEAT EXCHANGERS—Left to right, this installation consists of (a) *high pressure feed water heaters:* design pressure of 1,100 psi, tested at 2,200 psi on the tube side—effective surface areas, 935 and 1,355 sq. ft. respectively; (b) *intermediate-pressure heater,* with effective surface area of 1,310 sq. ft.; (c) *low-pressure heater* effective surface 1,750 sq. ft.

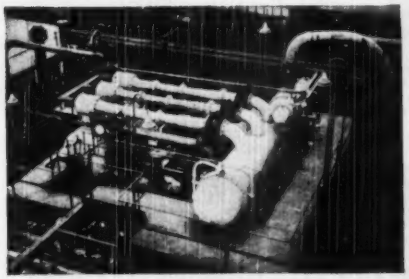
To serve most efficiently in power, refinery, or process plant, heat-transfer equipment must combine enlightened design with superior materials and high-calibre workmanship. Just such a "formula" is realized in each of these five units, representing some of the many types of equipment which Lummus designs and builds to help raise the output and lower the costs of industry.

Lummus, which operates its own manufacturing plant, has an unusually valuable background of experience to apply to your heat exchanger requirements. Throughout the world, Lummus units are operating economically through wide temperature ranges and pressures varying from near-total vacuum to 4,000 psi.

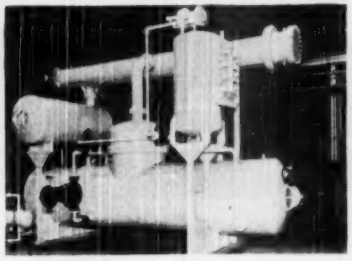
Special-design or standardized, the best formula for efficient heat transfer in your plant is "designed and built by Lummus."



LUMMUS MULTILOK CLOSURES—This catalyst reactor is one of many types of high-pressure equipment with Lummus patented Multilok Closures. These trouble-saving, cost-saving closures are used on feed water heaters and on refinery, chemical, and general industrial high-pressure units with both stationary and floating heads.



LUMMUS STEAM JET REFRIGERATION UNIT—This 350-ton unit, shown before insulation and painting, is installed in the wax de-oiling unit of a large modern refinery. Furnished complete with surface-type condensers and all control equipment, this Lummus unit is arranged so that any single booster or balanced combination of boosters can be operated at reduced tonnage.

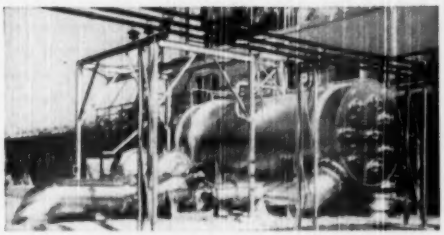


LUMMUS EVAPORATORS—Lummus kept this package unit within space limitations by mounting the deaerating feed preheater, the evaporator condenser, the condensate receiver, and the control equipments all on common supports with the evaporator. Evaporators of this type are continuously producing vapors with less than 1.0 p.p.m. solids content when the total solids in the shell liquid is maintained at 3,000 p.p.m.

THE LUMMUS COMPANY
Heat Exchanger Division
385 *Madison Avenue, New York 17, N. Y.*

LUMMUS

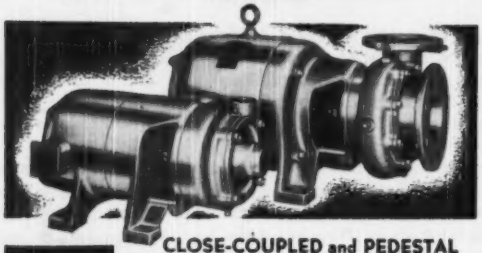
Atlanta • Boston • Chicago • Cleveland
Detroit • Ft. Worth • Houston • Minneapolis • Pittsburgh
Rochester • St. Louis • San Francisco • Wayne (Phila.)
Athens • Buenos Aires • Honolulu • London • Manila
Montreal • Paris • Rome • San Juan, P. R.



LUMMUS CONDENSERS—This 27,500-square-foot, 2-pass, nondivided waterbox-type surface condenser is a part of a Lummus installation for a southern utility. It was furnished complete with 2-stage, twin-element air ejector and single-stage priming ejector.

LOOK TO LUMMUS for Steam Surface Condensers • Evaporators • Feed Water Heaters • Boiler Blowdown Heat Exchangers Steam Jet Air Ejectors • Steam Jet Refrigeration • Barometric Condensers • Heat Exchangers • Process Condensers • Reboilers Steam Generators (Indirect Fired) • Fuel Oil Heaters • Lubricating Oil Coolers • Pipe Line Coolers • Jacket Water Coolers

New... Different
THE "ALTA" LINE
FOR INDUSTRIAL USE



CLOSE-COUPLED and PEDESTAL GORMAN-RUPP PUMPS

This new line of centrifugal pumps combines all the advantages of exact hydraulic engineering with best mechanical design.

Alta Pumps are outstanding in efficiency serving a capacity-head range up to 1000 G.P.M. and 200 feet head with 14 sizes, 1 to 4 inches.

Open as well as enclosed type impeller for slurry and other services.

For detailed information ask for Bulletin 9-IP-11.

THE GORMAN-RUPP COMPANY
MANSFIELD, OHIO

Over 150 different sizes and models!
CHELSEA FANS

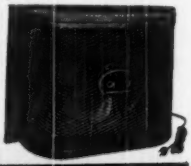
— for every industrial and commercial requirement!

Specifying Chelsea Fans for every installation is one sure way to proper ventilation. There's a Chelsea model for every requirement — and each type is certified as to performance in accordance with the Standard Code of the Propeller Fan Manufacturers Association.

Chelsea All-Purpose Fan Type BB—For removing smoke, steam, heat, fumes, etc. Heavy duty, direct drive fan for continuous operation. Recommended for use against static pressure and in duct work. One piece panel and orifice. Lightweight, simple to install. Sizes from 16" to 30".

Chelsea Industrial Fan Type IND — For large general area ventilation. Moves large volumes of air under pressure. "V" belt drive; Sizes from 24" to 60".

Chelsea Spin-It-Fans — Reversible window fan for drawing-in or exhausting air. Two speed, for cooling and ventilating, and subsequent operation.



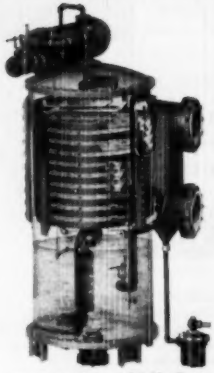
SEND FOR YOUR FREE KIT!

Contains all the information you need to make ventilating and cooling installations in factory, plant, office or shop — selection of proper fan, installation hints, etc. No obligation. Write Department H.

CHELSEA FAN & BLOWER CO., INC.
1206 GROVE ST. IRVINGTON N. J.

FULL STEAM AHEAD—AT LOWER COST!
with STICKLE Open Coil Feed-Water Heaters

Wherever Stickle Open Coil Heaters are used to preheat feed-water, boiler efficiency is greatly increased—fuel costs are greatly reduced. Stickle Open Coil construction brings preheated feed-water into direct contact with the steam, permitting immediate transmission of heat from steam to water *at the temperature of the steam within the heater shell.* Steam condensed in heating feed-water provides one-sixth of your boiler feed supply—every bit of it *pure* water, distilled and free from scale-forming substances. Three-section, circular trays provide extra-surface—heat more water to higher temperature in less space than any other heaters on the market. Get all the money-saving details! Send for free Stickle Bulletin No. 117, complete with a wide variety of clear-cut illustrations.



"X-Ray" View of Stickle Open Coil Deaerating Feed-Water Heater with cast iron shell.

CHECK THESE FEATURES!

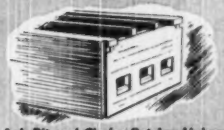
- *Heats water to higher temperature in less space.*
- *Improves quality of feed-water.*
- *Automatically controls admission and overflow.*
- *Provides fully one-sixth of boiler-feed supply* from steam condensed in heating feed-water.
- *Requires minimum maintenance.* Trays are easily removed for cleaning. Scale is eliminated from heater walls.
- *Available in 10 standard sizes* in single heaters; 6 sizes in dual heaters. Capacity, 3,000 to 250,000 lbs. Deaerating and non-deaerating types.

STICKLE EQUIPMENT

STICKLE STEAM SPECIALTIES CO.
2265 VALLEY AVENUE INDIANAPOLIS, INDIANA

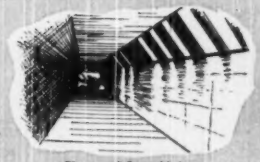
WHERE TO USE LUMNITE IN POWER PLANTS

Steel Stack Linings



Ash Pit and Cinder Catcher Linings

Coal Bunker Linings



Flue and Duct Linings

Overnight Structural Concrete

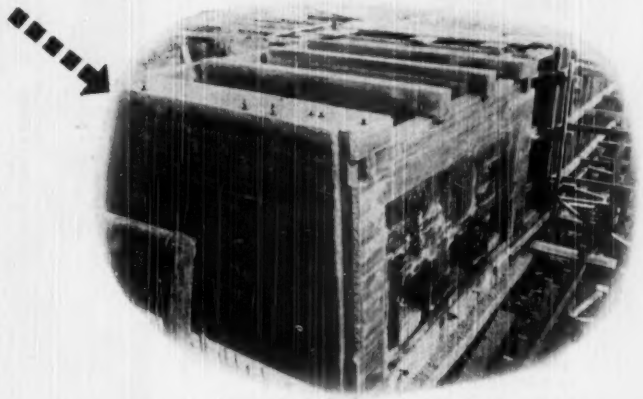
Castable Refractories

Factory-prepared mixtures of LUMNITE and selected aggregates. Mixed with water on the job, cast into place for door linings, arches, baffles, furnace walls. Special shapes can be cast in molds, ready within 24 hours. Castables to meet different temperature and insulation needs are made by manufacturers of Refractories, sold by their distributors.

Tough *LUMNITE Concrete

WITHSTANDS HEAT... CORROSION...WEAR

in self-lined Ash Pit



This combination boiler foundation and self-lined ash pit, built with heat-resistant LUMNITE concrete, is protected against soaking furnace temperatures, corrosion and wear from ashes and cinders.

Monolithic-concrete construction provides smooth surfaces with no joints to wear ragged and tear out. No refractory lining is needed with concrete made of LUMNITE calcium-aluminate cement and crushed fire brick aggregate. Such concrete remains sound and strong under continuous soaking heat from the boiler—it withstands temperatures well above 2000°F.

You also get fast construction with LUMNITE, the rapid hardening cement. Outage time is reduced to a minimum because LUMNITE concrete reaches service strength in 24 hours or less.

In ash pits, cinder catchers, and other power plant installations, as listed in column at left, LUMNITE combines high-early structural strength, high heat- and corrosion-resistance. Lumnite concrete also provides low thermal conductivity when insulating aggregates are used. Send for further information.

**"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

P-L-13

Lumnite Division

UNIVERSAL ATLAS CEMENT COMPANY

UNITED STATES STEEL CORPORATION SUBSIDIARY

135 EAST 42nd STREET • NEW YORK 17, N. Y.

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—NBC Network*

Because they're years ahead in steam generation...

only CYCLOTHERM STEAM GENERATORS

Trade Mark Reg.

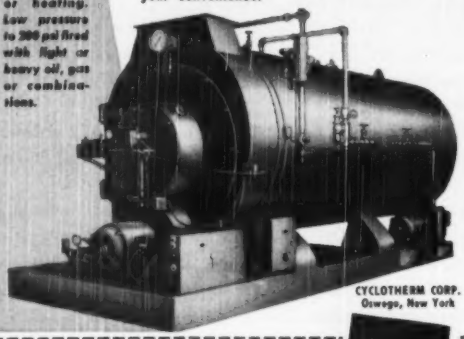
have cyclonic* combustion POWER

***WHAT IS IT?** It's the modern scientific discovery of transferring heat at the highest degree of efficiency with a new low in fuel consumption. Principal factors of which are the cylinderized solid flame with its exclusive cyclo-motion power, designed to utilize the full potential of every particle of fuel . . . and the thin layer of air resulting from centrifugal force that's always between the flame and wall of combustion chamber. A combination to produce steam far in excess of conventional standards for measured heating surfaces.

SEND FOR *ALL* THE BIG REASONS

Learn how the completely automatic Cyclotherm with its unexcelled all-in-one package type features wipe out waste and excess costs. If you are planning a new or replacement boiler installation it will pay you to first get the facts on Cyclotherm. The coupon below is for your convenience.

***SIZES** available to fit your steam or water load for processing or heating. Low pressure to 300 psi fired with light or heavy oil, gas or combinations.*



CYCLOTHERM CORP.
Oswego, New York

CYCLOTHERM CORP., OSWEGO, N. Y.

Gentlemen: Please send me bulletin P-1 showing the advantages of Cyclotherm's new concept in Heat Transfer. Without obligation, of course.

DEPT. P8

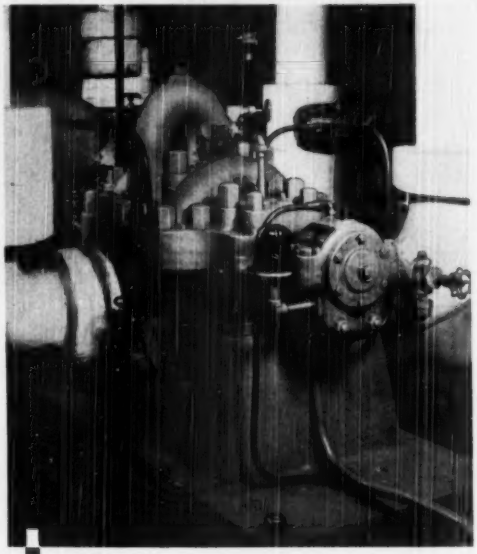
NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

AMERICAN BOX BOARD COMPANY
GRAND RAPIDS • DETROIT • FILER CITY • CHICAGO
GRAND RAPIDS 2, MICHIGAN

Installs 2 AMERICAN-MARSH OSMH MULTI-STAGE CENTRIFUGAL PUMPS



For low operating cost!

Shown above is one of the new modern OSMH pumps installed by the American Box Board Co., outstanding manufacturers of container board and containers. Twelve important operating features* combine to give you economical initial cost and installation, plus high, lasting efficiency. Simplicity of design lends to low operating cost and low maintenance expense.

MEMBER HYDRAULIC INSTITUTE U.S.A.

*Ask for Bulletin 382 which clearly outlines these 12 features.

AMERICAN-MARSH PUMPS
BATTLE CREEK MICHIGAN

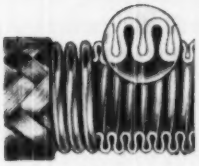
For troublesome connections . . .

CMH

FLEX[illegible] METAL HOSE offers [illegible] economical, dependable solution

Scores of troublesome connection problems where there is movement between parts, misalignment, vibration or expansion and contraction are effectively solved with CMH Flexible Metal Hose. Manufactured in a variety of types and a variety of metals, CMH Flexible Metal Hose is available for pressures from vacuum to 12,000 psi (burst) and for temperatures from sub zero to 1600° F.

If you do not already have literature describing the CMH line of flexible metal hose products, write for it, today, mentioning the types of connection problems you have.



CMH corrugated metal hose is manufactured in steel, bronze, stainless steel and other alloys and is available with or without metal braid covering. Convoluted hose, conduits, expansion joints, bellows and specialty items are also included in the CMH line.

Flexon identifies CMH products that have served industry for over 48 years.

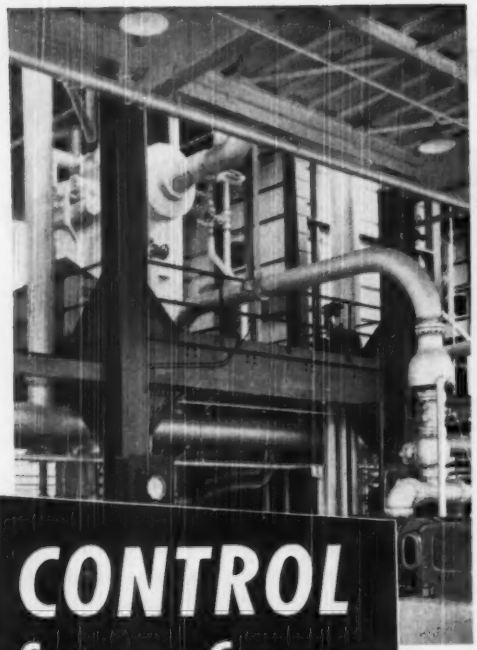
CHICAGO METAL HOSE Corporation

1301 S. Third Avenue • Maywood, Illinois • Plants at Maywood, Elgin and Rock Falls, Ill.
In Canada: Canadian Metal Hose Co., Ltd., Brampton, Ont.

CMH

ONE DEPENDABLE SOURCE
for every flexible metal hose requirement

Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems
Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components



CONTROL
Scale and Corrosion

IN BOILERS, WATER JACKETS, CONDENSERS

—Wherever Water is Used

Increase the efficiency and life of vital plant equipment by using WRIGHT Water-Conditioning Chemicals.

Write for helpful information

Wright CHEMICALS

WRIGHT CHEMICAL CORPORATION
Specializing in Water Conditioning
GENERAL OFFICE AND LABORATORY
617 West Lake Street, Chicago 6, Illinois
OFFICES IN PRINCIPAL CITIES
Sole Distributor of Nelson Chemical Proportioning Pumps

Are you equipped to hold your job?—to get a new one?

The men who are keeping their jobs today—who are not feeling the whip of competition—are those who have kept one jump ahead of their jobs. They are the men who are equipped with a thoroughgoing and growing knowledge of the business they are in.

It works in the power plant field as well as in any other. Some men fit themselves to do a little more than their job calls for. They fit themselves to do a little more than the other fellow. They make a steady effort to equip themselves with the best kind of job insurance there is—KNOWLEDGE.

How about you? Do you know how quickly knowledge will pile up—how quickly you will become more valuable—if you spend a few minutes a day, regularly studying sound books like the McGraw-Hill Library of Power Plant Practice? Do you know how easily it can be managed, paying only a few cents a day, while you use the books?

Thousands of men have followed this plan to win advancement or to make their jobs safe. You can too. Read about this Library and our Free Examination Offer. Then send the attached coupon to us today.

POWER PLANT PRACTICE

(6 volumes—2,477 pages, 2,404 illustrations)

The Library of Power Plant Practice is the standard of the power plant field. It is accurate—it is thorough—it is complete. It is the result of years of experience with power plant problems. The man who has it has the best. The Library covers the whole field—nothing is omitted. The solution of every problem is plainly worded or explained with a clear illustration. The little stickers and the big troublesome problems are all worked out in advance for you. There can be only one result from studying these books a few minutes each day—more money in your pocket.

No books dealing with the work of the power plant man were ever so complete—so authoritative—so practical in text and illustrations as these. The man who puts this set of books into his library can do so knowing that he has the utmost in power plant books—a set that will give him, in language he can understand, all the information he needs in order to get ahead in his work.

Easy to Understand

These books are written in everyday easy-to-understand language. They are written to help the man on the job. It is just as if the author were working in the plant by your side and giving you the benefit of his vast knowledge, man to man. There is no bunkum in this Library, nor is it cluttered up with impractical theories. It is a Power Plant Library FOR POWER PLANT MEN.

Glance at the titles of the books in the photograph. They will give you an idea of how completely this Library covers Power Plant Practice. Here you have all the information necessary to make you indispensable on the job.

See it 10 days—Send no money

Fill in and mail the coupon below and we will send you the six volumes of the Power Plant Library for 10 days' examination. If you decide to keep the books after examining them, just send $3.50 and then $3.00 a month until the total low price of $18.50 has been paid. See the coupon below for details. Send it Now and HOLD THAT JOB!

McGRAW-HILL ON-APPROVAL COUPON

McGRAW-HILL BOOK CO., INC., 330 West 42nd St., N. Y. C. 18
Ship to me charges prepaid the six volumes of the library of Power Plant Practice. If satisfactory, I will send $3.50 in ten days and $3.00 a month until the price of $18.50 has been paid. If not wanted I will return the set to you.

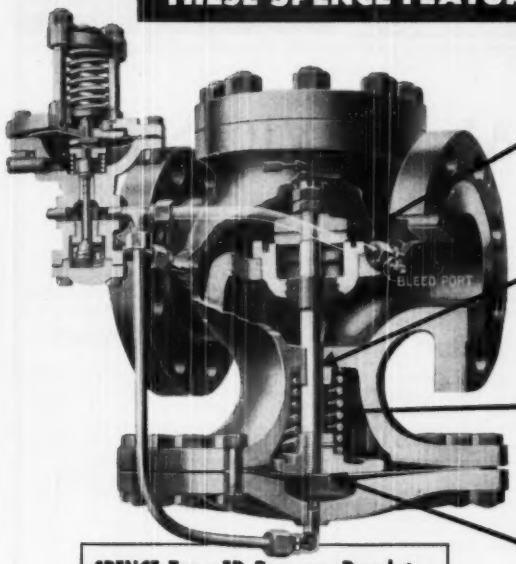
Name .....
Home Address .....
City ..... Zone ..... State .....
Company .....
Position P-4-50

Books sent on approval in U. S. and Canada only.

HERE'S PROOF

You Can Cut Costs of Pressure and Temperature Control

THESE SPENCE FEATURES SHOW YOU HOW



SPENCE Type ED Pressure Regulator

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. More than twenty years of experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

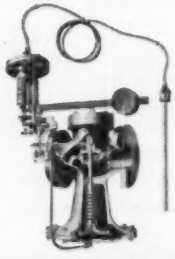
PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

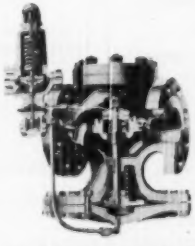
LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

YOU BENEFIT by these and many other Spence features that assure *accurate, dependable* regulation year after year. That means *less down-time, less time and money wasted on replacement of parts.*

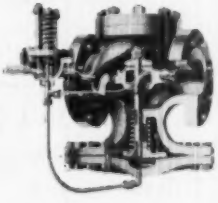
Spence Pressure and Temperature Regulators are built in sizes from *¼" to 12"* for service with *air, steam, water, oil or gas.* Only minor adjustments are needed to switch any Spence Regulator from one service to another.



Type ET150 Temperature Regulator—Tops in performance for both storage and instantaneous heaters.



Type EN Differential Regulator—Accurately controls differential between fluid delivered by regulator and some other source of pressure connected to the pilot spring chamber.



Type EQ Back Pressure Regulator — Completely packless, pilot operated for accurate control of the initial pressure.

These Companies Have Profited with SPENCE!

The Springs Cotton Mills
Ford Motor Company
Pennsylvania Power & Light Company
Jones & Laughlin Steel Corporation
National Tube Company
The Atlantic Refining Company
Great Lakes Steel Corporation
Todd Shipyards Corporation
Land O'Lakes Creameries, Inc.
General Electric Company
R. J. Reynolds Tobacco Company
Ohio Edison Company

and thousands of others

SPENCE ENGINEERING COMPANY INC.
WALDEN, NEW YORK

Spence

WHERE TO BUY

Featuring additional products specialties and services for power plants

"MONO"
BOILER BAFFLES
HIGH TEMPERATURE
Refractory Cements
SANFORD C. SMITH REFRACTORIES, INC.
1715 NIAGARA ST., BUFFALO, N. Y.

STICHT FOR TACHOMETERS
HERMAN H. STICHT CO., INC.
27 PARK PLACE N.Y.C.

ERNST Liquid Level Gages
High and Low Alarm Columns
Split-Gland Water Gages
Sight Flow Indicators
Flat Glass Inserts
Etc.
WRITE FOR BULLETINS
ERNST WATER COLUMN & GAGE CO.
LIVINGSTON, N. J.

PROFESSIONAL SERVICES

CONSULTING
CONSTRUCTION
DESIGN
PLANS
EXAMINATIONS
SURVEY • REPORTS
PATENTS
TRADE MARKS

BURNS & McDONNELL
Consulting and Designing Engineers
Kansas City, Mo. — P. O. Box 7088
Cleveland, Ohio — 1404 E. 9th St.

CONSULT THESE SPECIALISTS:
Let them save your time by bringing their broad experience in their specialty to bear on your problems.

J. E. SIRRINE COMPANY
Engineers
Power Plants, Design, Water, Greenville
Steam Utilization
Consultations, Reports, Plans
South Carolina

THE H. K. FERGUSON CO.
Industrial Engineers and Builders
POWER PLANT DEVELOPMENT
ENGINEERING AND CONSTRUCTION
The Ferguson Building, Cleveland, Ohio
Chicago • Houston • Los Angeles • New York City

FRED L. PEARSON
Reg. Mechanical & Electrical Engineer
Steam—Diesel Power Plants, Water Supply, Sewage disposal, Heating, Air Conditioning, Electrical distribution systems, Design Construction and Supervision.
204 Commerce Building — Detroit 26, Michigan

STANLEY ENGINEERING COMPANY
Consulting Engineers
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Hershey Building — Muscatine, Ia.

GILBERT ASSOCIATES, INC.
Engineers and Consultants
Industrials and Utilities, Power Plant Design and Construction. Rehabilitation and Maintenance.
Steam — Diesel — Hydro — Sewage
Reports — Examinations — Laboratory
New York, Houston — Reading, Pa. — Philadelphia, Washington

PIONEER SERVICE & ENGINEERING CO.
Consulting and Design Engineers . . Purchasing . . Specialists in Financing, Accounting and Other Operations
231 So. La Salle St. — Chicago 4

JOHN A STEVENS, INC.
Established 1909
Consulting Engineers
Power Plants, Dye Houses — Paper Mills, Surveys
Lowell, Massachusetts

THE KULJIAN CORPORATION
Engineers - Constructors
Power Plants and Industrial Projects
1200 N. Broad St., Philadelphia 21, Pa.
Washington, D. C. — St. Petersburg, Fla.
Calcutta — Rome — Caracas

SANDERSON & PORTER
Engineers and Constructors
New York — Chicago
San Francisco — Los Angeles

SYSKA & HENNESSY, INC.
Engineers
Consultation, Power Plants — Plans, Water Systems — Reports, Disposal Plants
144 East 39th Street
New York, New York

T. MASENG & ASSOCIATES, INC.
Engineers
Electrical, Design — Structural, Reports — Mechanical, Rates
7 So. Dearborn — Chicago 3, Ill.

SARGENT & LUNDY
Engineers
140 South Dearborn St. — Chicago, Illinois

THE J. G. WHITE ENGINEERING CORPORATION
Design-Construction-Reports-Appraisals
80 Broad Street, New York 4

"By reason of special training, wide experience and tested ability, coupled with professional integrity, the consulting engineer brings to his client detached engineering and economic advice that rises above local limitations and encompasses the availability of all modern developments in the fields where he practices as an expert. His services, which do not replace but supplement and broaden those of regularly employed personnel, are justified on the ground that he saves his client more than he costs him."

For Your

ENGINEERING REFERENCE FILE

POWER offers the following reprints of special editorial sections, covering subjects of vital importance to power men everywhere. Use the coupon below to order those you want.

Cost Postpaid

1. LICENSE REQUIREMENTS — 32-page survey by OPERATING ENGINEER summarizes stationary-engineer license laws of: (1) U. S. states and cities over 50,000 population (2) Canadian provinces, and (3) U. S. merchant marine 25c
   (For orders of 10 to 100 copies, 20c; 100 copies or more, 15c)

2. HIGH-TEMPERATURE METALS—16 pages reviewing for power engineers the basic properties of metals and alloys, the effects of temperature, the development of the new "super alloys" and the problems of designing equipment for high temperature service 20c

3. BUILDING HEATING — 20 pages covering fundamentals of heating, hookups and equipment for steam, hot-water and warm-air heating systems 25c

4. CIRCUIT PROTECTION—16 pages covering devices for over-current protection in circuits of 600 volts and below. Describes and shows application of fuses, circuit breakers and associated thermal and magnetic devices ... 20c

5. INDUSTRIAL POWER CLUTCHES —16-page special section describes applications, construction, operation, and characteristics of manually and automatically applied power takeoffs, line-shift clutches and clutch couplings, including magnetic and hydraulic drives 20c

Cost Postpaid

6. MODERN DIESEL ENGINES — 50 Years of Progress. 32 pages. Explains how diesels work, auxiliaries, construction, inlet air, gas, supercharging, injection, lubrication, etc. 50c

7. FLEXIBLE COUPLINGS — 16-page special section tells what flexible couplings do and how they are selected, describes various types 20c

8. COMBUSTION CONTROL — 36 pages covering what automatic controls do and how they do it, plus detailed explanations of current types of control systems and how they are applied 45c

MAIL THIS COUPON

Editor, POWER, 330 West 42nd Street, New York, 18, N. Y.

Please send me ..... copies each of the reprints represented by the number circled below. I enclose check ( ), money order ( ) for $ .....

1 2 3 4 5 6 7 8

Name .....

Address .....

City ..... Zone No. .....

State 6/50P

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE
(Not available for equipment advertising)
$1.20 a line, minimum 4 lines. To figure advance payment, count 5 average words as a line.
INDIVIDUAL EMPLOYMENT WANTED undisplayed advertising rate is one-half of rate, payable in advance.
PROPOSALS, $1.20 a line an insertion.

INFORMATION

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 1 line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $10.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns — 30 inches—to a page.

NEW ADVERTISEMENTS received by June 9th at the New York Office, 330 W. 42 St., N. Y. 18, will appear in the July issue, subject to limitation of space available.

POWER PLANT MAINTENANCE FOREMAN

An east coast utility now constructing a new 120,000 k.w. high-pressure pulverized fuel generating station has immediate need for a maintenance foreman. Must have good background of experience and be able to direct the maintenance of all power plant equipment such as boilers, turbines, pulverizers, pumps, fans, air compressors and coal handling. Must have good mechanical ability and be able to take full charge of maintenance crew under the direction of the master mechanic. Job located near desirable residential community. Permanent position, excellent working conditions, forty-hour week, paid vacations, insurance and retirement plan. Include complete resume of experience and qualifications in first letter together with recent photograph. Applications will be treated confidentially.

P-6658 POWER
330 W. 42nd St., New York 18, N. Y.

SALES ENGINEER

Now it is possible to PREVENT formations and accumulations of Slag and Fireside deposits on boilers and furnaces. Our new System causes the complete combustion of the Combustibles in the furnace area. The Ash is deposited in the Ash Zone instead of entering the tube bank or building up, on the walls. Smoke Control is an accomplished fact. This System was developed through long research by a Nationally known, well established Manufacturer.

The importance of this new development to Industry offers an exceptional opportunity to Sales Engineers throughout the East, South and Midwest, who have Combustion experience in the Industrial and Utility Power Plant fields.

State experience and qualifications in reply.

SW-6533, POWER
520 N. Michigan Ave., Chicago 11, Ill.

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42 St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

WANTED: POWER Plant Superintendent for a large industrial plant in Maryland. Applicant must be under 40 years of age, possess the degree of B.S. in M.E. from an accredited college, and have had at least 10 years' experience in the various phases of power plant operation and maintenance. He must be familiar with powered coal and stoker-fired boilers, and steam turbine and switchboard operation. Refrigeration plant experience is also desirable. Salary open. The Power Plant which he will superintend has an approximate steaming capacity of 500,000 pounds per hour. About half of this capacity is utilized for electrical current generation and the rest, including by-product steam from the turbine, is utilized for process requirements. P-6405, Power.

WANTED CHIEF Steam Electric Engineer: Utilities Company in New Mexico. Technical graduate or equivalent with experience in operation and maintenance of modern steam-electric plant; also supervisory ability. All replies held in strict confidence. P-6514, Power.

ASSISTANT GENERAL Superintendent required for integrated steel plant in Pittsburgh district. Must be capable of directing operations from steel making to finished sheet, strip and merchant mill products. Opportunity for man with tonnage steel plant experience. P-6588, Power.

ASSISTANT SUPERINTENDENT Electrical Maintenance Department for integrated steel plant Pittsburgh district. Must be capable of directing all phases of electrical maintenance and maintenance crews. College man with experience in tonnage steel plant operations preferred although former not necessary if man has necessary ability and experience. P-6589, Power.

SELLING OPPORTUNITY OFFERED

HELP WANTED Male. Openings in desirable territories for men with boiler room contacts to sell NCC sludge solvent and No-Karb soot remover. Nutmeg Chemical Co., 134 Haven St., New Haven 13, Conn.

EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (40 years recognized standing and reputation). The procedure, of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 2451 Orange St., New Haven, Conn.

POSITIONS WANTED

OPERATION-MAINTENANCE Supt. or Asst. Twenty years experience with intimate knowledge of power plant and industrial steam and elec. generation and distribution. Also maintenance in large chemical process plant. Excellent personnel training and handling record. Some design and modernization. Available at once. PW-6314, Power.

Engineers — Executives — Technical Men
Salaried Positions, $4,000 to $30,000
This Confidential service for men who desire a new connection, will develop and conduct preliminary negotiations without risk to present position. Send name and address for details.
TOMSETT ASSOCIATES
1205-2 Berger Bldg., Pittsburgh 19, Pa.

POSITIONS WANTED

AGE 39, Registered Mechanical and Electrical Engineer, University graduate. Experienced in Power Plant, Street Car, and Automotive operation and maintenance. Supervised large groups of personnel. E. A. Babcock, 412 Otis Ave., St. Paul, Minn.

POWER PLANT Supervisor, technical school graduate, 7 yrs. of power plant operation and maintenance experience. Also some refrigeration. Age 28 yrs. PW-6647, Power.

MECHANICAL ENGINEER, B.S.M.E., June 1950. Age 30; 7 years experience with Navy power plants. Discharge Warrant Machinist. Wishes permanent position with established company. PW-6631, Power.

To EMPLOYERS who advertise for MEN:

Frequently, when there are many applicants for a position, only the most promising letters are acknowledged. The other applicants never know whether their letters reached a prospective employer or not. These men often become discouraged, will not respond to future advertisements and even question their bona fide character.

Every advertisement printed in the Searchlight Section is duly authorized.

You can help keep our readers interested and get better returns to your advertising in this section if you acknowledge each reply — in plain envelopes, if you wish.

Classified Advertising Division

McGRAW-HILL PUBLISHING CO., INC.

"Put yourself in his place."

POSITIONS WANTED

(Continued from the opposite page)

POWER ENGINEER—Twenty-five years experience, operation and maintenance of modern power plants, electrical equipment, refrigeration, air conditioning and water filtration plants. Fifteen years high pressure plant, some construction experience, desire supervisory-engineer position with a utility, industrial plant or municipality. Registered engineer, gold seal licensed power plant operator. Will relocate or travel. PW-6662, Power.

SELLING OPPORTUNITY WANTED

PITTSBURGH DISTRICT—Manufacturers Agent interested in obtaining a Water Tube Boiler Account on exclusive basis. Has aggressive, hard working engineering sales force thoroughly trained in Steam Generation. RA-6356, Power.

BUSINESS OPPORTUNITY

Patented Machine

washes venetian blinds. Highly profitable. Visit one of 50 successful plants near you. Free booklet. $6350.00 in 24 payments. C. C. Equipment Co., 101 S. 44th St., Phila. 4, Penna

OFFICIAL PROPOSALS

ANNOUNCEMENT

In accordance with the rights stipulated in the conditions of adjudication, the Egyptian Government hereby announces the cancellation of the two adjudications for the civil engineering and building works and for the sluice gates, pipe lines and surge tanks, for which tenders were invited to be submitted by the Fourth of May and which invitation was then postponed by Circular Letters Number Thirteen and Two dated Thirty-First March Nineteen Hundred Fifty respectively. The purpose of this cancellation is to combine the above-mentioned works after being modified together with the remaining works of the scheme in one general adjudication in which the whole works shall be awarded to one main contractor for the facility of execution and unifying of responsibility. The new call for tenders for the said works will be announced at the earliest opportunity. The Egyptian Ministry of Public Works, Cairo, is ready, on the returning of the documents of the cancelled adjudications, to refund the sums previously paid by the tenders in obtaining these documents.

FOR SALE

COAL AND ASH HANDLING EQUIPMENT

at Baltimore, Maryland.

Partially installed in 1943. Never used. Consists of coal conveyors, coal elevator and attendant equipment of 25 tons capacity bituminous per hr. Also, Riley No. 5 duplex Atrita pulverizer with attendent equipment of 20,600 lbs. capacity per hr. Also, conveyors and attendant equipment for ash and fly ash removal of 14 tons dry ash capacity per hr. Bids desired on as is, where is basis. Address inquiries to Mr. C. E. Paules, attention: Mr. A. B. Strickler, Standard Oil Development Company, Esso Engineering Department, P. O. Box 121, Linden, New Jersey. Telephone: Elizabeth 2-3900.

One Union Iron Works Bent Water Tube Boiler 300 Horse Power, W. P. 160 Pounds With Detroit Stoker. One Economic Fire Tube Boiler 200 Horse Power, W. P. 200 Pounds. One Indian Oil Filter, Size 48 Inch. No reasonable offer will be refused.

MEADOW GOLD PRODUCTS CO.
1337 D Street, S. E., Washington, D. C.

LEFAX POCKET SIZE TECHNICAL DATA BOOKS $1. EACH

Printed on loose leaf, six hole, 6¾" x 3¾" bond paper each book contains about 140 pages of technical data, presenting condensed, accurate and essential data for the student, engineer, technical worker and business man.

Architecture	Metals	Relays, Meters
Home Heating	Gen'l Chemistry	Hydraulics
Illumination	Reinf. Concrete	Surveying
Electrician's Data	Building Constr.	Mech. Drawing
Builder's Data	Radio	Machine Design
Lumber Data	Television & FM	Machinist's Data
Air Conditioning	Electricity, AC	Piping Data
General Math.	Electricity, DC	Surveying Data
Math. Tables	AC Motors and Generators	Trig.-Log Tables
Physics		Metallurgy
Chemical Tables	Transformers	Analytic

Write for FREE Catalogs (over 2000 listings). See for yourself how helpful LEFAX can be to you. Send $1 for each book, or $5 for any six books listed.

LEFAX DEPT. PO 2 PHILADELPHIA 7, PA.

STEAM ENGINE

Allis-Chalmers Heavy Duty Reliensing type Corliss, 20"x42", 105 RPM 150#-3# pressure. V-belted to Allis-Chalmers, 480 volt, 60 cycle, 3 phase, 280 KW generator. Exciter V-belt driven from generator shaft. Complete with switchboard. Excellent condition. Can be seen in operation. Available immediately. Larger set has been installed.

LOUISVILLE COOPERAGE CO.
421 West Avery St., Louisville, Ky.

UNIT SUBSTATIONS FOR SALE

2—New 500/1000 K.V.A. General Electric Type HUT, Oil Immersed, Self-Cooled, 55° C. Rise 12,000-2400/4160Y Volts, 3-Phase, 25/60 Cycle, Master, Outdoor, Unit Sub-stations, for One Incoming 12,000 Volt, 3-Phase, 3-Wire Circuit and Two Outgoing 4160 Volt, 3-Phase, 4-Wire Circuits, Connected and Assembled for Operation at 60 Cycles, 1000 K.V.A. Rating.

Price and Detailed Specifications will be furnished upon request.

SALT RIVER POWER DISTRICT
P.O. BOX 1980
PHOENIX, ARIZONA

New and Used Equipment Available for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
Send for new list to
EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE Two Rector St., New York 6, N. Y.

FOR SALE

2 Transformers, 1000 KVA, G.E. 11,470—2400 V, 3 phase, 75 KVA to 1½—2400/4160—120/240 all late model. 1 Turbogenerator, 2000 gross, condensing, 120 V, D.C. 3 Circuit Breakers, 15,000 V, 600 AMP, G.E. type FLO-1A. 20 Kelman 7500 V, 400 Amp. and 100 Amp. type F-1 and 611. 1 20,000 gal/day and 2—4000 gal/day, salt water distillation units. 1 60 H.P. drum hoist.

LEWON BROS.
1155 HARRISON ST., SAN FRANCISCO 3, CAL.

FOR SALE

One complete 1250 H.P. Diesel Plant. First Class Condition. Nordberg Engine, G.E. Generator and all auxiliary units.

BELTON LIGHT AND POWER CO.
Belton, S. C.

WANTED

WANT TO BUY
Surplus VALVES and Flanged Pipe Fittings
PRUDENTIAL PLUMBING PRODUCTS CORP.
261 East 134 St., New York 54, N. Y.

Air Compressors Wanted
Horizontal Water Cooled—Any size also 2 Stage portable unit
L. W. BAUER
North Bergen, N. J.

WANTED

4000 KW Marine Generator, 33,000 Volt Transformers and Insulators.
Circuit Breakers 7500 volts 100,000 KVA Interrupting capacity or greater—preferably enclosed in metal cabinets.

RM. 4200, 310 SOUTH LaSALLE ST.
CHICAGO 4, ILLINOIS

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES
No lengths too long or too short
TELEPHONE: EASTGATE 7-4778
PIERCE CABLE CO.
2668 CLYBOURN AVE., CHICAGO 14, ILLINOIS

If there is anything you want
or something you don't want that readers can supply—or use—*advertise it in the*
Searchlight Section

WANTED A.C. MOTORS
FOR CASH
ALL SIZES 1 to 300 HP
SEND LISTING — COMPLETE DESCRIPTION
Industrial Electric & Supply Co., Inc.
Box 1398—Memphis, Tennessee, Dept. A

ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

WRITE FOR NEW STOCK LIST No. 1622

VARIABLE VOLTAGE DRIVES

40 HP Reliance Variable Voltage Drives, each Consisting of:
1—40 KW 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP 400/1500 RPM, Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing leg forward, leg reverse, run, fast, slow, and stop, and motor operated field rheostat.

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	H.P.	Speed	Volts	Make	Type
6	7½	810	550	G.E.	MTC-5201
2	10	1140	440	West.	HF-7A
2	10	570	220	G.E.	HI-11
2	11‡	820	550	G.E.	ITC-5008
2	15	1160	440	West.	CW-664C
2	15	570	220	West.	CW-646
1	18	680	440	West.	MW-316
1	20	860	440	West.	CW-638
1	25	1130	550	G.E.	MT-323
2	25	350	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	865	440	West.	CW-646
1	30	350	440	G.E.	MT-332
1	30	675	440	G.E.	MT-336
2	35	600	440	F-M	HV-H16A
2	40	865	2200	Al.Ch.	ARV-223C
1	40	560	440	G.E.	MT-346
2	50	1150	440	G.E.	M-536
1	50	870	440	West.	HF-12A
1	50	570	440	G.E.	MT-352
5	52‡	550	220	G.E.	IQC-5013 ***
1	60	685	440	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	345	550	West.	CW-858
1	80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IL-16
2	150	1750	440	G.E.	MTP-549
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
3	200	600	440	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
4	350	1775	2300	G.E.	IM-E15A
2	350	900	2200	G.E.	IM-17A
1	400	505	550	West.	CW
1	600	1770	440	G.E.	IM-E15C
1	650**	380	440	G.E.	MT-442Y
1	700	720	4000‡‡	West.	CW

220 volt motors can be reconnected for 440 volts.
‡ Intermittent rating. *** 2 phase.
** New. ‡‡ 25 cycle.

A.C. GENERATORS — NEW

3 Phase, 60 Cycle, 0.8 P.F., Two Bearing, with Damper Winding and Direct Connected Exciter.

Quan.	KVA	RPM	Volts	
4	18.7	1800	Columbia	240/120
5	18.7	1800	Columbia	208/120

230 VOLT CONST. SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
10	3	850	Reliance	Y-23T
25	3½	850	West.	SK-30
1	7½	1150	G.E.	CDM-65
3	7½	850	G.E.	CD-75
10	10*	1750	Kimble	HA-324
5	10**	1150	Al.Ch.	EB-80
2	10	850	West.	SK-83
10	13½**	850	West.	SK-93
3	15	1750	G.E.	CD-75
5	15	825	West.	SK-90
1	20	1750	L.A.	GNA-L851
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-110L
17	25	825	West.	SK-120
1	30	1100	G.E.	RC-12
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-150
1	50	950	G.E.	RC-16
1	60	1750/1310	West.	SK-143
1	150	700	Al.Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
6	5/7½	600/1800	G.E.	RA-30
1	10	400/1600	Reliance	T-92T
2	10/15	600/2400	Reliance	T-92T
1	12½	230/340	West.	SK-130
10	12½**	600	West.	SK-93
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RF-11
1	20/25	400/1600	Reliance	T-23-T
1	20/25	300/1200	West.	SK-153
1	25	400/1600	G.E.	RF-13
1	25	500/1500	G.E.	RF-12
1	23/29	300/1200	G.E.	RF-13
1	30	400/1200	West.	SK-163
1	30/40**	400/1600	G.E.	CD-1236
1	35	500/1500	West.	SK-143
1	40/50	400/1200	Reliance	T-4611
11	75	500/1500	Cr.Wh.	CCM
1	75	375/750	Cr.Wh.	CMC-125H
5	100	225/900	G.E.	MPC-A
5	100	400/1200	Al.Ch.	
1	100	320/960	West.	SK-200
1	125	450/1000	West.	SK-190
1	175	230/500	West.	SK-220
2	375	350/500	G.E.	MPC

**New.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.
Totally Enclosed Fan Cooled, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
1	5	3480	220	G.E.	K-225
2	5	1750	440	L.A.	JA-254
10	5	1730	440	G.E.	K-254
2	5	1165	440	L.A.	JA-284
5	7.5	1740	440	G.E.	K-284
1	10	3480	440	West.	CS-324
1	10	1140	440	Wagner	CP2-326
1	10**	880	220	West.	CS-365-K *P
1	15	1745	440	West.	CS-326
1	15	1175	440	L.A.	JA-365
1	20	1760	220	G.E.	K-364
1	25	1760	220	G.E.	K-365
1	25	1200	550	G.E.	K-405
1	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504
1	40	3565	440	G.E.	KF-4058

Splashproof, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
23	5	1750	440	L.A.	FS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
1	10	3480	440	G.E.	K-284
1	15	1175	440	L.A.	JA-365
4	15	1170	440	L.A.	FX-365
2	40	1175	220	G.E.	K-445
3	50	1760	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
1	125	1770	440	L.A.	FX-1078Y
1	150	1775	440	L.A.	FX-1168
3	150	880	440	L.A.	FX-1368
1	150	700	440	G.E.	KF-6335
1	200	885	440	L.A.	FS-1378

Open Type Motors

Qn.	HP	Speed	Volts	Make	Type
1	15	3485	220	Reliance	AA-B3247
5	15**	1735	440	Century	8C326
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-326
5	20**	1750	440	Wagner	RPI-364
1	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KF-512
2	20	1160	440	West.	CS-464C
2	20	900	220	G.E.	FTR-522
1	25	1800	220	G.E.	KT-312
5	25**	1740	440	Century	8C-364
1	25	1160	440	West.	CS-667C
1	25	900	220	Howell	RCRR-556***
2	25**	875	440	Master	PB-405
2	25	575	440	G.E.	KT-542
3	30	3550	550	G.E.	K-3648
1	30	1160	440	West.	CS-644
1	30	870	220	West.	CS-646
1	40**	3545	220	G.E.	KF-4048
2	40	1750	440	West.	CS-583C
2	40	900	2300	G.E.	FTR-536
4	50**	1750	440	Wagner	RP5-405
1	50	850	220	West.	CCL
2	60**	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-346
1	75	1160	440	West.	CS-642C
1	75	870	220	West.	CS-764A
2	75	865	2300	G.E.	KT-353
1	100	690	220	West.	C
1	100	580	2200	G.E.	IR-15A
2	100	500	2200	West.	CS-830
1	100	495	2200	Al.Ch.	AN
2	125	435	440	Al.Ch.	AR
2	125	460	2300	G.E.	I-17-FR
1	200	580	550‡‡	G.E.	KT-5668
2	300	587	2200	West.	CS-39A
1	400	1165	2200	G.E.	IR-E13B
1	500	1200	440	G.E.	KTP-567
1	700	1800	2300/4000	West.	CS-4-391J-12

220 volt motors can be reconnected for 440 volts.
**New. ***2 Phase. ‡‡Reconnectable for 440 volts.

G. E. DYNAMOMETERS

Cradle Type, with Control and Dial Scale
(Write for Complete Specifications)

Qn.	HP	DC Volts	RPM	Type
1	50/75	250	1650/4000	TLC-20
2	100	250	1050/3600	TLC-50
1	200	250	1200	C

MOTOR GENERATOR SETS

125 and 250 Volt D. C.
(Write for complete Specifications)

KW	Make	RPM	DC Volts	AC Volts
2	Const.	1750	125	220/440
7.5**	West.	1455	125	380/220‡
10	West.	1750	125	220/440
10	West.	1450	125	220/440†
10	West.	1150	250	220/440
15**	G.E.	1800	125	220/440
15	G.E.	1755	250	220/440
15	West.	1450	125	220/440‡
16	West.	1750	125	2200/440
20	West.	1750	250	220/440
25	G.E.	1800	250	220/440
25	G.E.	1200	125	220/440
30	G.E.	1800	250	220/440
30	Al.Ch.	1750	125	220/440
50	West.	1750	250	220/440
50	G.E.	720	125	220/440†
75	G.E.*	1200	125	220/440
75	G.E.	1200	250	2300/440
100	Columbia*	1200	250	2300/440
150	West.*	1200	250	2300/440

Note: 3KW, 5KW & 7.5KW, 250 V Sets Available
**New. *Synch. Motor Driv n. ‡50 Cy. †25 Cy

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located in Our Cleveland Warehouse. We Have Controls for Most Items Listed.

ELECTRIC GENERATOR & MOTOR CO.
4521 HAMILTON AVE. CLEVELAND 14, OHIO

MERCURY ARC RECTIFIERS
1—300 KW G.E. 250 V. DC, 2300 V. AC
1—300 KW WEST. 250 V. DC, 2300 V. AC

MOTOR GENERATORS
1—500 KW G.E. Syn. 250 V. 900 RPM
1—400 KW WEST. Syn. 600 V. 720 RPM
2—300 KW G.E. Syn. 250 V. 1200 RPM
1—300 KW G.E. Syn. 600 V. 1200 RPM
1—200 KW G.E. Syn. 250 V. 1200 RPM
1—200 KW G.E. Syn. 600 V. 1200 RPM
1—150 KW G.E. Syn. 250 V. 1200 RPM

ROTARY CONVERTERS
1—300 KW G.E. Syn. 600 V. HCC 1200 RPM
2—150 KW G.E. Syn. 250 V. HCC 1200 RPM

GENERATORS & ARMATURES
2— 50 KW G.E. 600 V. DLC 1200 RPM Gen.
1—500 KW G.E. 250 V. MPC 900 RPM Arm.
1—900 KW G.E. 250 V. HCC 1200 RPM Arm.

WALLACE E. KIRK COMPANY
502 Grant Bldg., Pittsburgh 19, Pa.

DIESEL GENERATOR SET!

225 HP Busch Sulzer Model DF, 3 cyl., 4 cycle, solid injection, 360 RPM. Direct erator with direct connected exciter, air connected 150 KW 3/60/2300 volt genfilter, muffler, etc. A modern unit in perfect condition only $4000 f.o.b. St. Louis.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. St. Louis 1, Mo.

LARGE QUANTITY

NEW ILG MARINE BLOWER FANS 24"—6250 C.F.M. 33"—10000 C.F.M. 36"—15000 C.F.M. Axial Flow—Propeller Type. Driven by 230 Volt D.C. Motors.

ELECTRIC APPARATUS REPAIR CO.
1400 N. 6th St. Phila. 22, Pa.

480 HP BUCKEYE

Diesel Engine, 8 Cylinder 10½"x12" stroke, 600 RPM Model 80, late type. Rebuilt.

ALJON ELECTRIC DIESEL CO.
904 Pacific Street Brooklyn 16, N. Y.
STerling 3-6515

CONSULT US FOR
Diesel Gasoline and Steam Generators, Electrical and Industrial Equipment
POWERITE CORPORATION
140 Cedar St. New York 6, N. Y.
Dept. 105 BA 7-8199

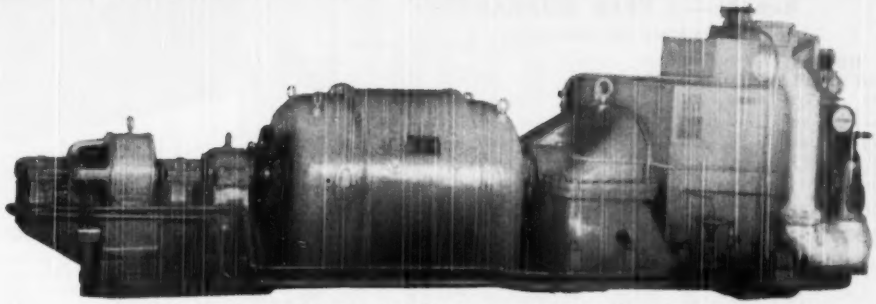
asme — BOILERS — nat'l. b'd.

2—404 H.P.	Springfield sectional, oil
1—250 H.P.	Stirling, Coal stoker
2—500 H.P.	Erie City, oil
2—600 H.P.	Stirling type, Spreader stoker
2—42"	Suspended HRT, hard fired
2—84"	

H. P. BREARLEY
34-23—31st Street, Jackson Heights, N. Y.

CONSULT
with us on
Boilers, Turbines, Engines Diesels, Generators, M.G. Sets, Transformers & Switchgear.
MERRILL and COMPANY
407 So. Dearborn St. • Chicago 5, Illinois

POWER PLANT MACHINERY



1250 KVA WESTINGHOUSE AUTOMATIC EXTRACTION TURBO UNIT

1250 KVA Westinghouse generator, 3 phase, 60 cycle, 480 volts, direct connected to Westinghouse automatic extraction condensing turbine, 150-200# steam pressure, 100° superheat, 0-10# extraction pressure, 3600 RPM. Equipped with direct connected exciter, switchboard, surface condenser and auxiliaries.

TURBINE GENERATOR UNITS—3 phase 60 cycle

6250 KVA Allis condensing, 200# steam, 2400/4160 volts.

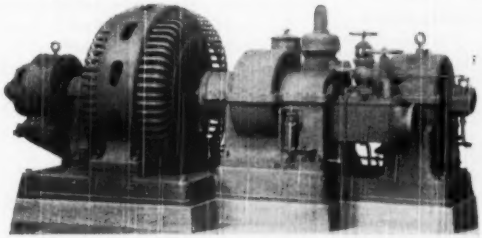
5000 KVA G.E. non-condensing, 600# steam, 50# exhaust, 150# extraction, 13,800/6900/4000 volts.

3125 KVA (New) G.E. condensing, 600# steam, 13800/4150/2300/480 volts.

2500 KVA (New) G.E. automatic extraction, 600/400# steam, 100/150# extraction, 4150/2300/480 volts.

1875 KVA Allis condensing 200# steam, 2300 volts.

1250 KVA Westg., condensing, 150/200# steam, 240/480 volts.



625 KVA WESTINGHOUSE NON-CONDENSING TURBO UNIT

625 KVA Westinghouse generator, 3 phase, 60 cycle, 480 volts, 900 RPM, direct connected through reduction gear to Westinghouse non-condensing turbine 150-200# steam pressure, 0-100° superheat, 0-10# back pressure, 6000 RPM. Equipped with direct connected exciter and switchboard.

UNIFLOW UNITS—3 phase 60 cycle

750 KVA Ames Vertical, 150# steam, 5# exhaust, 4000/2300/480 volts.

625 KVA Skinner, 150# steam, 5# exhaust, 240/480 volts.

500 KVA Skinner, 150# steam, 5# exhaust, 2300/480 volts.

375 KVA Skinner, 150# steam, 5# exhaust, 2300/480 volts.

250 KVA Skinner, 150# steam, 5# exhaust, 480 volts.

250 KVA Ames Vertical, 150# steam, 5# exhaust, 480 volts.

188 KVA Ames Vertical, 150# steam, 5# exhaust, 480 volts.

175 KVA Skinner, 150# steam, 5# exhaust, 240 volts.

DIESEL UNITS—3 phase 60 cycle

625 KVA Worthington, 2300 volts, 225 RPM.

450 KVA (3) Alco, 480 volts, 514 RPM.

375 KVA Fairbanks-Morse, 2300 volts, 300 RPM.

250 KVA (2) Fairbanks-Morse, 2400/4160 volts, 300 RPM.

187 KVA (3) Buckeye, 240/480 volts, 400 RPM.

150 KVA Fairbanks-Morse, 240 volts, 257 RPM.

93 KVA (3) Cooper Bessemer, 220 volts, 400 RPM.

Send Us Your Inquiries for Power Plant Machinery

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. **Telephone: MAin 1-9514** **CLEVELAND 14, OHIO**

Reliably Rebuilt Electrical Equipment

Rebuilt — 1 YEAR GUARANTEE

PARTIAL LISTINGS ONLY

MOTORS
Squirrel Cage 3 Phase

HP	Make	Type	Speed
450	GE(vert)	KF-6338	1180
200	Wagner	RP2	1750
200	GE	KF-6335	880
150	West(2)	CS	1750
150	West	CS	580
125	AlCh(2)	AR	435
100	Wagner New	XP	1150
100	GE	K-544	1175
100	West	CS	870
100	GE	IK	720
75	West	CS	1750
75	GE(3)	K-505	1175
75	GE	IK	900
75	GE(3)	KT-352	865
75	West	CS	720
75	GE	K-356	690
75	GE	KT-558	580
60	F-M	Tot.Enc.	1650
60	West(2)	CS-607	880
60	Rel(2)	AA	875
60	GE	KT-346	865
50	GE	FTR-523	3600
50	Elliott	196	3450
50	West	CS	1740
50	LA(3)	XP	1150
50	West	XP	1150
50	GE	KF-445	1170
50	West	CS-642C	1160
50	West(3)	CS	870
50	GE(2)	IK	870
50	GE	FTR-542	870
50	West	CS	690

MOTORS
Slip Ring 3 Phase

HP	Make	Type	Speed
600	CrWh	131AQ	507
500	GE	IM	1200
500	GE(2)	IM	450
400	West	CW	514
225	Wagner	25cy	710
200	GE	MTP-557	1800
200	GE(2)	IM	1170
150	Wagner	31VRN	900
150	GE	MT-564Y	580
100	GE	MT-553	1165
100	AlCh		690
75	West.	CW	1150
75	GE		690
50	West.	HF	850
50	AlCh		690
50	GE	MT-536	1150
50	West	CW	1150
50	GE	MT-336	1150
50	LA	OGH	870
50	F-M	BV	660
50	AlCh	ARY	575
50	GE	IM	490

MOTORS
Synchronous

HP	Make	Type	Speed
600	AlCh(2)		120
475	West		720
400	GE(2)	TS-9288	600
300	GE	ATI	900
260	GE	TS	900
250	Ideal		360
200	GE(2)	25cy	500
200	Ideal	SMW	257
180	GE	ATI	900
160	GE	TS	1200
145	GE	ATI	720
135	West	G	1200
135	Ideal		1200
100	GE	TS	1200
100	ElMach		200
55	ElMach	BRKT	1200

MOTORS — 230V. D.C.

HP	Make	Speed
400	AC	415
135	CW	233/900
125	GE	1750
100	GE	1750
100	AlCh	1150
90/45	GE	950/475
75	Sprague	1000/1500
75	West(2)	475
75	CrWh	480/670
75	CrWh	375/950
75	West(3)	250/1000
60	West(3)	680
50	GE	1750
50	Diehl	850/1050
45/90	GE	475/1950
50	West(3)	565
50	GE	250/1000
50	West	250/1000
40	West	1750
40	Century	1740
40	GE	1700
40	GE	1100
40	GE	750
40	GE(2)	400/1500
40	CrWh	700
40	Rel	400/1200
35	West	1150
35	GE	440/800
30	GE(8)	2200
30	West	975
30	Cont	850
30	GE	775
30	West	500/1500
30	West(2)	575
25	GE	1750
25	West	1750
25	GE	1750
25	ED	1500
25	Rel	1150
25	West	500/1500
25	West(2)	600
25	GE	300/1200
40	Rel(4)	1750
42	ABC(2)	1200
30	GE	1200
25	GE	1200

MOTORS—550V. D.C.

HP	Make	Speed
765	GE(6)	1045/1350

GENERATORS
250V. D.C. M.D.

KW	Make	Speed
1000	GE	900
500	West	1100
300	Elliott	1200
300	GE	1200
300	AlCh	1200
200	GE	1200
150	West	900
100	Delco	1200
75	GE	1200
50	GE	1200

GENERATORS
125V. D.C. M.D.

KW	Make	Speed
250	GE	720
150	CrWh	1200
150	West	1150
100	West(2)	900
100	GE	1200
100	ElMach	1200
75	CrWh	1200
75	Hertner	1150
50	West	1150
50	CrWh	1150
50	Sturt	2800
35	Ideal	1200
30	GE	1150
30	LA	1450
25	ElMach(2)	1150

A.C. GENERATORS
Driven by D.C. Motors

KVA	Make	DC Input	AC Output
288	West	115	450
75	GE	230	240
50	Star	115	120
35	GE	230	220
31	Ideal	115	440
31	ElMach	230	440
18	GE	230	120/240
10	Burke	115	120
7½	Hertner	115	440
5	ElSpec	115	110
1¼	AlCh	230	110

GENERATORS—A.C.

KW	Make	Type	Speed
216	West	G	900
180	GE	ATB	900
100	GE	ATB	360
75	GE(2)	ATB	1200
50	F-M	GG	1200
15	GE	ASI	1200

TRANSFORMERS

4—333 KVA Moloney, 2300/4600 V. primary, 230/460V. secondary.
1—300 KVA, Al. Ch. 3 ph, 41600 V. primary, 230V. secondary.
1—300 KVA, Pittsburgh, 3 ph, 41600 V. primary, 230V. second.
8—100 KVA West. 3 ph. 440-220 Dry.
2—50 KVA GE—H—KF, 2400/4160Y—120/240V. secondary.
4—25 KVA West 440V. primary, 110/220V. secondary
3—15 KVA West 440V. primary, 110/220V. secondary.
60—Additional Oil and Insulated Dry-type Transformers in stock not listed, down to 1 KVA.

375 KVA WORTHINGTON DIESEL POWER PLANT

Emergency Stand-By Plant — NEVER OPERATED! Test Service Only!

REALLY NEW — Very Latest and Best Money Can Buy

Consist of: 3—125 KVA Westinghouse 3 ph. 60 cy. 460 Volt .8 PF AC generators 600 RPM direct connected 6 driven by 150 H.P. 600 RPM Worthington 5 cylinder 600 RPM Model BB5 Diesel engines. Complete Installation, Cubicle Panel Board and Distribution Panels, Electric & Gasoline Air starting compressors and tanks, Day tanks, pumps, evaporative coolers, surge tanks, silencers, etc.

A COMPLETE INSTALLATION • BARGAIN PRICE

IMMEDIATE SHIPMENT FROM OUR N. Y. STOCK

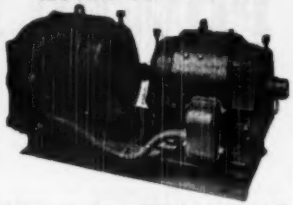
PHONE OR WIRE!

L. J. LAND, INC.

EST. 1910 — 41st YEAR

156 GRAND ST. CAnal 6-6976 NEW YORK 13, N. Y.

MOTOR GENERATORS



DIEHL 120V. D.C. to 120V. A.C., 60 cy., 1 Ph. 2.5 K.V.A. Complete with magnetic controller, 2 field rheostats and full set of spare parts including spare armatures for generator and motor.

New $185.00

ALLIS CHALMERS 115V. D.C. to 120V. 60 cy., 1 Ph. 1.25 K.V.A., P.F. .80 Centrifugal starter. Fully enclosed.

New $97.50

Same as above but for 230 V. D.C. input **$110.00**

O'KEEFE AND MERRITT, 115V. D.C. to 120V. A.C., 50 cycles, 2 K.V.A., Pf. .9.

New $165.00

ELECTROLUX Dynamotor 105/130 V. D.C. at 6 amps. to 26 or 13V. D.C. at 20 amps. or 40 amps. respectively. Fully filtered for radio use and complete with Square "D" lineswitch. Navy type CAJO 211444.

New $69.50

Send for our complete list.

ELECTRONICRAFT
6 WAVERLY PLACE TUCKAHOE 7, N. Y.
PHONE: TUCKAHOE 1-0044

Diesel Engines for Sale

2 Venn-Severin 75 HP Diesel Engines 400 RPM, Mfg. in 1938, belted connected to 60 KVA General Electric 3 phase, 50/60 cycle, 220 volt alternators.

Price ..... $1,500.00 Ea.

Can be inspected on original foundation under power.

Excellent condition.

A. J. WINSTON
517 South Delaware Street
Indianapolis 4, Indiana

MODERN AIR COMPRESSORS

6040 Ft. INGERSOLL RAND 60 LB. ELECTRIC.
3—3865 Ft. NEW CHICAGO PNEU. OCE. ELEC. 125 LB. WITH MOTOR TO SUIT.
3170 Ft. SULLIVAN WN4 ELECTRIC. 125 LB.
1578 Ft. CHGO. PNEU. DIEBEL. 125 LB.
1302 Ft. INGERSOLL RAND PRE-2 ELECTRIC. 100 LB.
610 Ft. WORTHINGTON V BELT DRIVE. 125 LB. WITH OR WITHOUT MOTOR.
DARIEN, 60 E. 42nd St., New York 17, N.Y.

MARINE AND STATIONARY POWER

Diesels—150/1800 HP.
Generators—30/1000 KW, AC-DC.
Turbo Gen., 5/6000 KW, AC-DC.
Boilers, 600/3000 HP.

SUNDFELT EQUIPMENT CO., INC.
220 Hudson St., Seattle 8, Washington

NEW and REBUILT
MOTORS
GENERATORS
TRANSFORMERS
1 to 1800 H. P.
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, NEW YORK
Write For Free 1950 Catalog

Behind the word

GUARANTEED

ARE YEARS OF HEMPHILL EXPERIENCE IN SELECTING, REBUILDING AND TESTING UNDER SUPERVISION OF ELECTRICAL ENGINEERS

TRANSFORMERS — 60 Cycle

Qu.	KVA	MAKE	TYPE	Ph.	VOLTAGES
1	1000	GE	Auto	3/2	4150 x 2406
1	1000	GE	Auto	3	3810Y-2300Y
1	500	Kuhl.	OISC	1	4600 x 2300V.
3	400	GE	H	1	6900 x 2250V.
1	300	Pitts.	ODSC	1	7800 x 440V.
3	300	GE	H	1	2400 x 120/240
1	200	Whse.	Auto	3/2	4150 x 2300
1	200	Pitts.	OISC	1	4000 x 110/220
1	200	GE	Auto	3/2	4150 x 2400
1	150	GE	KS	1	2300 x 230
1	100	Pitts.		1	2750 x 110/220
3	100	Wagner	RCKV	1	240 x 120/120
2	100	Whse.	SK	1	4400 x 220/440 Taps
2	100	Newark	Dry	3/2	440 x 220
3	100	GE Pyrn.	H	1	4160 x 220/440
3	100	GE	Auto	1	4150 x 2300
1	100	Amer.	OC	1	15000 x 2300
3	75	GE	H	1	2400 x 220/440
3	75	Whse.	SK	1	2400 x 440
7	50	Whse.	SK	1	13750 x 125/250
11	50	GE	H	1	13750 x 125/216
5	50	Whse. Inert.	S	1	4160 x 120/240
2	37½	GE	H	1	2400 x 120/240
2	37½	AC Dry	AD	1	450 x 120
1	37½	Amer.	RS	1	13800 x 220/440
1	37½	GE	H	1	13800 x 220/460
1	37½	Amer.	OISCID	1	13200 x 220/440
3	27½	GE	Dry	1	440 x 220/110
12	25	Whse.	Dry	1	440 x 220/110
1	25	Maloney	Oil	1	230/460 220/110

A.C. GENERATORS
3 Phase, 60 Cycle

Qu.	KVA	MAKE	TYPE	VOLTS	SPEED
1	2500	Whse.		2300	720
1	625	GE	ATB	600	2600
1	375	AC		480	450
1	300	GE	ATB	600	600
1	200	AC		240	3600
1	200	Whse.		240	600
1	225	Whse.		550	514
1	125	GE	ATB	240	600
1	170	Whse.		2200	900
2	50	Whse.		220/440	900
3	44	Columbia		240	1200
1	31	Amer.		120/208	1200
1	18.75	Star		220/440	1800
1	12.5	Whse.		240	1200

D.C. MOTORS

Qu.	HP	MAKE	TYPE	VOLTS	SPEED
1	125	GE	RC	230	1700
1	100	GE	LC	230	625
1	80	GE	CDM	230	1750
1	75/100	CW	CMC	230	800/1000
1	75	CW	WP	230	880
1	75	GE	C	230	575
1	50	GE	CD	240	650/1300
1	50	CW	CM	230	700
1	40	GE	LC	230	700/1000
1	35	GE	RC	230	860
1	30	GE	CDM	230	1600/1850

D. C. MOTORS (Cont.)

Qu.	HP	MAKE	TYPE	VOLTS	SPEED
1	30	GE	RC	230	1150
1	30	GE	RC	230	1100
1	30	GE	C	230	625
1	30	GE	RLC	230	400/1200
1	25	Whse	SK	230	825
1	25	Whse.	SK	230	600
1	25	Whse.	SK	230	400/1200
1	25	CW	CMC	230	335/670
1	25	Whse.	SK	230	300/1200

MOTOR GENERATOR SETS
3 Phase, 60 Cycle

Qu.	KW	MAKE	SPEED	DC	AC
1	1000	Whse.	720	275	2300/4150 Syn.
1	1000	GE	514	600	2300/4150 Syn.
1	500	GE	900	275	2300/4150 Syn.
1	400	GE	900	275	2300/4150 Syn.
1	200	GE	1200	250	2300 Syn.
2	150	GE	1200	125/ 250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	CW	1200	125	2300 SC
1	100	CW	1200	125	220/440 SC
1	100	El.Mach.	1200	125	4150 Syn.
2	75	GE	1200	125	220/440 SC
6	75	GE	1200	60	220/440 SC
1	50	Ridgeway	1200	550	220/440 SC
1	50	Whse.	900	260	220/440 SC
2	40	El.Mach.	1750	125	440 SC
1	35	Ideal	1200	125	220/440 SC

OIL CIRCUIT BREAKERS

1—3000	A GE	15000V	3 pole	FK	120
1—3000	A GE	4500V	3 pole	FK	12
2—3000	A GE	600V	3 pole	K	25
1— 600	A Condit	15000V		DR	100
1— 400	A Whse.	37000V		O	221

FLEX ARC WELDER
2—500 Amp. Whse. AC Welder

SPECIAL
1—120 KW 150 KVA Ames Uniflow 16 x 16 220V, 3 ph, Non-Condensing.

NEW CONTROL
4—150 HP GE CR 7051 Sq. Cage Automatic 440V, 3 ph.

Welding Motor Generator Set
1—176 KVA 2202 .57 PF single phase with exciter and 75 HP motor and controls.

A.C. MOTORS
3 Phase, 60 Cycle
Synchronous

Qu.	HP	MAKE	TYPE	VOLTS	SPEED
4	200/100	Whse.		4150	720/360
1	200	El.Mach.		2300	360
1	200	GE	TS	440	257
1	185	GE	ATI	2300	720
1	150	GE	TS	220	1800
2	150	AC		2300	360
1	100	GE	ATI	2200	900
1	70	El.Mach.		2200	180
1	35	GE	ATI	2200	1200
1	20	Whse.		220	1800

SLIP RING

1	2800	GE	MT	6600	257
1	800	GE	MT	2300	720
1	300	Whse.	CW	440	600
1	250	Whse.	CW	440	600
1	200	Whse.	CW	440	600
1	150	GE	IM	440	450
1	100	GE	IM	440	400
1	75	GE	MT	220	1200 Vert.
1	75	GE	MT	440	900
1	60	GE	MT	220	1750
1	60	GE	MT	440	900
1	50	GE	MT	220	1720
1	50	GE	MT	220	1200
1	50	Whse.	CW	220	900
1	50	GE	MT	220	1700
1	50	GE	MT	220	600
1	40	GE	MT	220	1200
1	40	G_eE	MT	2200	1200

SQUIRREL CAGE

Qu.	HP	MAKE	TYPE	VOLTS	SPEED
1	150	CW		2200	1200
1	125	GE	KF	2300	1800
1	125	US		440	1200 Vert.
1	120	LA	RY	440	1800
1	100	Whse.	CS	440	1800
1	75	GE	KF	220/440	1200
1	75	Ideal	AT	220/440	1200
1	60	Whse.	CS	2200	900 Vert.
1	40	GE	KT	220	1200
1	40	Whse.	CS	220	900
1	40/20	Whse.	CS	440	875/435
1	35	Whse.	CS	2300	1200
1	35	GE	TK	550	600
1	30	GE	KT	220	600
1	25	GE	KT	220	1145
1	25	GE	KT	440	1200

LARGE STOCK OF D.C. MOTORS AND GENERATORS, SWITCHBOARD AND CONTROL EQUIPMENT

JLHC

THIS SEAL IS YOUR GUARANTEE

"FOR POWER"

J.L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

MOTORS - M.G. SETS - CONTROLS

AT REDUCED PRICES!

M-G SETS

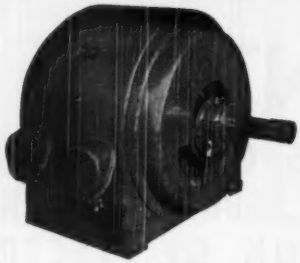
KW	D.C. Volts	A.C. Volts	Mfg.
500	250	2200	C-W
400	125/250	2300	Ideal
300	250	2200	G.E.
300	125/250	440/2300	Allis (New)
200	250	2200	Whse.
200	125/250	2200	G.E.
150	250	440	G.E.
125	250	440	Whse.
100	250	220/440	Star (New)
75	250	440	C-W
60	250	220	G.E.
50	250	440	Whse.

Reconditioned and guaranteed

NEW SYNCHRONOUS
500 HP, 600 RPM, Electric Machinery, 2300 V., 3 Ph., 60 Cy., 80% P.F. Pedestal Sleeve Bearing, with Base, Double Shaft—Short, complete with E-M Magnetic Controller.

SYNCHRONOUS

HP	RPM	Volts	Mfg.	Type
800	150	440	G.E.	80%
650	138	2300	Whse.	Engine
500	514	440	E-M	100%
400	900	2300	Whse.	80%
400	720	440	G.E.	80%
400	600	440	G.E.	100%
400	514	440	G.E.	100%
350	900	440	G.E.	100%
350	200	2300	Whse.	100%
300	514	440	G.E.	100%
250	600	4160	E-M	100%
150	900	4160	G.E.	80%
75	900	220	E-M	80%



SLIP RING

2—New 500 HP, 1200 RPM Elliott, 220/440 V., 3 Ph., 60 Cy., Shaft 4½" dia. x 8" long. (Photo above.) Control Available.

SLIP RING — R & G.

HP	RPM	Volts	Mfg.
700	720	2300	Allis
500	450	2300	G.E.
450	514	440	Whse.
350	900	2300	Whse.
350	450	2300	Whse.
250	900	440	Whse.
200	1200	440	G.E.
150	900	2300	C-W
125	900	440	Whse.
125	720	440	E-M
100	600	2200	A-C

NEW DIRECT CURRENT

230 Volt Drip proof — ball bearing

Qu.	HP	RPM	Mfg.	Frame
3	3	690/2660	G.E.	284
12	5	850/1700	G.E.	CD-66
5	7½	575/1750	G.E.	CD-77
2	7½	575/2300	Rel.	T-46
1	10	575/2300	L.A.	4051
3	10	1750	Rel.	T-34
2	30	850/1700	Rel.	T-230
1	75	400/1200	Rel.	T-651
5	250	1750	A-C	149

Reconditioned and guaranteed
230 VOLTS D.C.

HP	RPM	Mfg.	Brg.
250	400/1200	E-D	Ball.
200	300/ 900	Whse.	Ped.
200	400/1200	Rel.	Ball.
150	350/1200	Whse.	Ped.
150/200	300/ 900	Rel.	Ball.
125	400/1200	G.E.	Sleeve
125	300/ 900	Rel.	Sleeve
100	500/1500	C-W	Ball.
100	475/1350	E-D	Sleeve
75	500/1500	C-W	Ball.
60	400/1200	Whse.	Sleeve
50	350/1050	Whse.	Ball.
40	400/1600	Rel.	Ball.

NEW SLIP RING CONTROLS
10—250 HP 440/3/60 Fully Magnetic, Reversing, 7 steps acceleration, Allis-Chalmers, with air ckt. brkr. Open or enclosed.

Buy from BOSWICK with confidence

WAlbridge 1195

BOSWICK ELECTRIC CO.

P.O. BOX 55 — AKRON 9, OHIO

NORTHERN METAL CO. — MACHINERY at REDUCED PRICES

DIESEL GENERATORS

100 K.W. Allis Chalmers. 1944. 3/60/120/450.
Exciter: 3 K.W. 120 V. D.C.
Diesel Engine: Lorimer. Model F5SS. 150 H.P. 7½"x9½".
5 cylinder, with electric starting motor.

MOTORS

Westinghouse. 1944. Synchronous—Induction.
60 Pole. 3300 S.H.P. 3 Phase. 82.5 Cycles. 2200 Volts.
165 R.P.M. Power Factor 100%.
Exciter: 125 Volts D.C. Load Factor 100%. 1944.

BOILERS

WATER TUBE. Babcock & Wilcox. 1945. 2 Drum. Bent Tube. Economisers. Internal Desuperheater. Superheaters. W.P. 400 P.S.I. Hydrostatic Press. 718 P.S.I. Heating Surfaces: 2441 sq. ft. Superheater 350 sq. ft. Economiser 1620 sq. ft. 3 Todd "Hex Press" Fuel Oil Burners. Diamond Soot Blowers. Auxiliaries available.

NUMEROUS OTHER ITEMS ARE AVAILABLE

MILNOR & BLEIGH STS. • PHILA. 35, PA.
Phone MAyfair 4-1400

Compressors — Vacuum Pumps

"Recognition Is the Yardstick"
It's AMERICAN Rebuilts
Since 1902

SAVE 40%-60%

— SALE OR RENT —

STATIONARY — PORTABLE

PORTABLE
Special—315 CFM Ingersoll
International UD-18A Diesel—4 Pneu.
Late Model—Rental or Rental Purchase

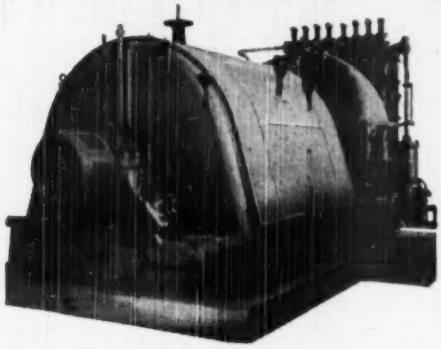
American Air Compressor Corp.
47th & Dell Ave., North Bergen, N. J.

ELECTRICAL CABLE
- for every industrial and power application
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

UNIVERSAL WIRE AND CABLE CO.
2668 N. Clybourn Ave., Chicago 14, Ill.

6250-KVA G. E. TURBINE-GENERATOR

A VERY HIGH GRADE MACHINE



SEND FOR BULLETIN NO. 415: CONTAINS SPECIFICATIONS.

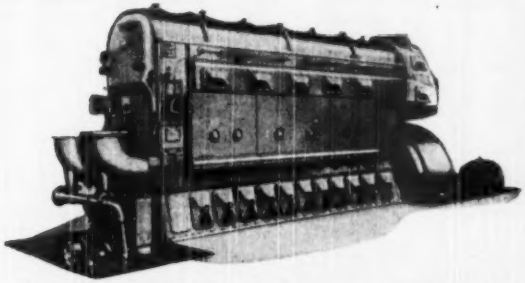
Above 6250-KVA., General Electric, is in A1 Condition. Complete, 200#-psig, 2300/4160-v, 3600-RPM., with 7000 sq. ft. Condenser with Auxiliaries.

OTHER TURBO-GENERATORS IN OUR STOCK

6250-KVA., G.E., 2300/4160v. Cond.
4375-KVA., G.E., Rebuilt: New Coils
3125-KVA., G.E., Complete, 250#
3125-KVA., West., 250#, 2300v. Cond.
2500-KVA., West., Non-C., 250# (2)
2500-KVA., G.E., 150#, Cond. 2300v.
1875-KVA., G.E., 250-psi., No. 1 unit
1875-KVA., Allis-C., Cond., 200#, 2300v.
1563-KVA., G.E., 200-psi, Non-C., 15/25-BP
1563-KVA., G.E., 225-psi, Cond., 2300v.
937-KVA., G.E., 150-psi, Non-C., 480v., 15-BP
937-KVA., Allis-C., Cond., 480v.
937-KVA., G.E., Cond., Rebuilt
625-KVA., West., Non-C., 300#-psi, 480v., 15/25-BP
625-KVA., G.E., Cond., 200-psi, 480v.
625-KVA. (2), G.E., Non-C., 480v., 150#, 15/25-BP
625-KVA. (2), DeLaval-Allis, 125#, 480v., 15/25-BP

COMPLETE DATA ON REQUEST, PLEASE SEND SPECIFICATIONS FOR ANY ITEM WANTED NOT LISTED

WE CARRY A LARGE STOCK OF DIESEL ENGINES, ETC.



BULLETIN 320 CONTAINS SPECIFICATIONS. SEND FOR IT TODAY.

Above Cut Shows a 1600-HP. Fairbanks-Morse Latest Model 38D8 1/8 Opposed Piston Diesel Engine, with New (never used) A.C. 3/60/2300/4160-v. Generator with Direct Connected Exciter Switchboard, Etc.

SPECIALLY ADAPTED FOR MUNICIPAL-ALL STATIONARY INSTALLATIONS

A FEW OTHER DIESEL POWER UNITS IN OUR STOCK:

6—Hamiltons, 1600-HP., 720-RPM., with West. Reversing Reduction Gears: SAME AS NEW; 15—Baldwin-Westinghouse 300-KW, DC., 240-v., 400-RPM.; 4—GM. Model 3-268-A, 100-KW. 4—FM. OP., 1200-HP., 720-RPM., Engines, 8-cyl. Nearly New. AND MANY OTHERS. Write Us, Giving Specifications.

Telephones
Woodward 1-1340
Woodward 1-1341
Woodward 1-6038

CHARLES WEAVER

4145 PENOBSCOT BLDG.
DETROIT 26, MICH.

OUR SLOGAN
Good Equipment
Immediate Deliveries
Right Prices

NO

YOU CAN'T BEAT GLOW FOR RELIABLE ELECTRICAL EQUIPMENT

SQUIRREL CAGE MOTORS

HP	RPM	Volts	Make
750	900	6600	Westgh
350	3550	2200	Westgh-CS
300	900	440	GE-I-17
250	1200	440	GE-KTR
250	600	2300	Triumph
225	514	440	GE-I-16
200	600	440	Westgh-CS
150	1800	440	Howell-SC
150	600	2200	GE
125	3600	220/440	Al.Ch.AN
125	1800	220/440	Al.Ch.AR
125	340	220	Al.Ch.

SLIP RING MOTORS

HP	RPM	Volts	Make
500	900	440	GE-3 Brg
400	1200	2300	Al.Ch.
375	1800	2300	Al.Ch.
350	900	2300	Westgh
300	720	2300	Al.Ch.
250	720	440	GE-MT
250	360	2300	Al.Ch.
200	1800	440	Al.Ch.
150	1750	440	GE-MT
150	900	2200	Al.Ch.
100	1200	550	Westgh-CW
100	600	440	W-E-118

MOTOR GENERATOR SETS

KW	DC Volts	HP	AC Volts	Make
1800	250	2500	4000	GE
750	240	1160	2300	GE
400	250	600	220/440	GE
200	250	415	440	GE-EM
200	250	300	440	GE
150	250	235	440	C-W-EM
100	275	150	440	Wtg.
75	125	115	440	GE
50	125	100	2200	Al.Ch.
32	125	50	440	GE
25	250	40	220	Reliance-GE
20	250	30	220	GE

SYNCHRONOUS MOTORS

HP	RPM	Volts	Make
3600	720	4800	Wtg.
1015	500	2200	Wtg-25 cycle
500	514	440	GE
435	720	2300	GE type ATI
330	900	2200	GE-ATI
250	1800	2300/4160	GE-ATI
250	225	2200	GE-TS
225	900	4160	GE-ATI
220	600	2300	GE-ATI
175	225	220	GE-TS (rotor & stator only
160	600	440	GE-ATI
160	164	480	GE-TRF (rotor & stator only
150	1800	2200	GE
150	1800	220	GE-ATI, single bearing
150	900	440	Star
150	720	440	Westgh

FREQUENCY CHANGERS

Output KW	Output Volts	Input Volts	Make
3000	2300	2300	GE
1700	250	Any	GE-HCC
1100	250	Any	GE-HCC
100	2300	575	Wtg.
25	220	115	GE
20*	220	220	Deko
15*	220	220	GE
10**	220	550/220	GE

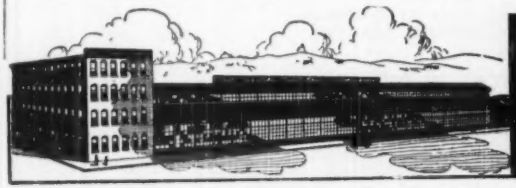
*60/180 cycles—**60/240 cycles

CAPACITORS

KVA	Volts	Phase	Make
75	440	1	Cornell-Dubilier
60	460	3	Westinghouse
15	460	3	General Electric
15	2400	1	General Electric

GLOW ELECTRIC CO., for over 44 years, has done engineered rebuilding of electrical equipment to assure you of quality and dependability.

We invite your inquiries.



GLOW ELECTRIC CO.

927 HARRIET ST. CINCINNATI 3, OHIO
PHONE MAIN 3024

MOTORS—M.G. SETS—TRANSFORMERS

SQUIRREL CAGE MOTORS 3-PHASE 60-CYCLE

Qu.	H.P.	Make	Type	Volts	RPM
1	400	G.E.	1-K	2300	514
1	400	G.E.	KT-412	2200	435
1	350	Whse.	CS	2300	1160
1	200	Al. Ch.	AK	220/440	580
1	150	C.W.	126Q	220/440	870
1	125	Whse.	CS-761C	220/440	1750
1	125	Whse.	CS-772S	2300	1170
2	125	C.W.		220/440	430
1	125	Al. Ch.	AB	220/440	435
1	100	G.E.	1K	220/440	1755
3	100	Whse.	CS-663C	220/440	1750
1	100	Al. Ch.	AR-226	2200	1160
1	100	G.E.	KT-556	2200	865
5	100	F.M.	H8	220/440	880
1	100	Al. Ch.		550	720
1	100	F.M.	H-241B	220/440	450
1	75	Whse.	CS	440	1750
1	75	Al. Ch.	AR	2200	1765
1	75	Burke	HM-10	550	720
3	50	Whse.	CS	220/440	690

SYNCHRONOUS MOTORS 3 PHASE—60 CYCLE

Qu.	HP	Make	P.F.	Volts	RPM
1	1440	Whse.	.8	2300	514
1	700	G.E.	.8	2300/440	720
1	400	Whse.	.8	440	600
1	268	Al. Ch.	1.0	2200	900
1	150	Whse.	1.0	2300	400
1	125	G.E.	.8	2200	900
3	100	Whse.	.8	440	1800
1	100	Whse.	1.0	2200	1200
1	100	Ideal	.8	440/220	900
2	100	G.E.	.8	440/220	600
1	60	G.E.	.8	440/220	1200
2	50	G.E.	.8	2200	600

SLIP RING MOTORS CONSTANT DUTY 3-PHASE 60-CYCLE

Qu.	HP	Make	Type	Volts	RPM
1**	2000	G.E.	MT	2300	240
1**	1500	Al. Ch.	ANY	2300	256

Qu.	HP	Make	Type	Volts	RPM
2**	1000	Al. Ch.	ANY	2300	225
1**	800	G.E.	MT-12	2200/6600	600
1***	700	G.E.	MT432	2200	400
1**	600	G.E.	MT-412	2200	720
1	500	G.E.	IM	2200/4400	600
1	500	Whse.	CW	2200	575
1	500	Whse.	CW	440	600
1***	500	G.E.	I.M.	440	450
1**	500	G.E.	MT412	2200	450
1	400	G.E.	IM	2200	870
1**	400	G.E.	IM	2300	590
1**	400	Al. Ch.	ANY	2200	585
2	400	G.E.	MT412	2200	450
1	300	G.E.	IM	2200	1200
1	300	Al. Ch.	ANY	2200	585
1	250	Whse.	CW	2200	580
2	200	Whse.	CW	440	600
1	200	Al. Ch.	ANY	2200	585
1	300	Whse.	CW	550	514
1	150	G.E.	IM	440	495
1	125	Whse.	CW	2200	870
1	125	Al. Ch.	ANY	220/440	900
1	75	G.E.	IM	220/440	695
1	50	G.E.	MT-536	2200	1150
1	40	Al. Ch.	ANY	2200/440	435

**—Mill type pedestal bearing design.
***—Pedestal 3 bearing

TRANSFORMERS—OIL COOLED

Qu.	K.V.A.	Make	Type	Phase	Voltage
2	4500	G.E.	HT	3	27000/13500/2300
3	1000	Pitts.	OISC	1	22860/11000/1100/2200
4	500	G.E.	H	1	13200/11880/220/440
2	333	G.E.	H	1	6900/11950T/230/460
5	333	G.E.	H	1	2300/460/230
3	200	Pitts.	OISC	1	13800/14400/220/440
3	150	G.E.	H	1	19000/9500/550/2300
3	100	Whse.	SS	1	12075/10925/460/230
6	100	G.E.	H	1	4160/7200T/120/240
3	75	G.E.	KF	1	2400/4160T/120/240
3	50	Al. Ch.	OISC	1	22000/220
2	50	Wag.	HM	1	13200/11880/575/287

MOTOR GENERATOR SETS 230 VOLT

Qu.	KW	Make	RPM	Volts DC	Volts AC
2	1500	G.E.	600	600	4160/2400
1	1000	Whse.	514	600	4160/2400
1	1000	Whse.	514	600	2200
1	750	Whse.	514	275/300	2200
1	600	Al. Ch.	900	250	2300
1	300	G.E.	720	125/250	2300/440
2	150	C.W.	900	250	2300/440
1	100	C.W.	900	250	2300/440
1	85	C.W.	1200	250	440
1	75	Whse.	1200	125	440/220
1	75	Al. Ch.	900	250	2300
1	75	Whse.	1200	250	2300/440
3	75	Star	1200	240	220/440
1 (3U)	50	Whse.	1200	120/240	440/220
1	25	G.E.	1800	125	440/220
1	50	Reliance	1800	250	440/220
3	25	Whse.	1200	120/240	440/220
1	15	Al. Ch.	1200	250	440/220
3	9	G.E.	1800	250	440/220

1—Reliance variable voltage set (2) 20-KW, 250-VDC Gen. with (1) 5-KW exciter and (1) 75-HP motor 440/230.

DIRECT CURRENT MOTORS 230 VOLT

Qu.	HP	Make	Type	RPM
1***	2500	G.E.	MCF-14	200/400
4***	1500	Whse.	Rmel.	600
1***	1250	Whse.	Mill	300/600
1	500	G.E.	MPC	160/320
1	400	Al. Ch.	Mill	400/1200
1	335	Whse.	QM	450/900
1	200	Nl. Dy.	23	400/1200
1	200	Whse.	SK	300/1200
1	150	G.E.	MPC	363/535
2	125/150	Rel.	2550T	300/900
2*	150	C.W.	83H	890
2	100	Rel.	1050T	400/1200
1*	50/75	Rel.	1995F	300/1200
1*	40/60	G.E.	CD-173A	400/1200
1	50	Whse.	SK	300/1200
1*	30/75	Whse.	SK-151L	400/1200
1	35	Whse.	SK-140	500/1800
1	25	Whse.	SK-111L	250/1000

***—600-VDC mill type. *—T.E.F.C.

T. B. MAC CABE COMPANY

4314 CLARISSA STREET PHILADELPHIA, PENNA.

Our 44th Year

WAGNER

Quality and Service

"CERTIFIED REBUILT"

DEPENDABLE ELECTRICAL EQUIPMENT AT LOW COST

MOTORS . . . GENERATORS . . . M-G SETS

M-G SETS

KW	Mfr	Input V		Output V
500	Whse.*	2300	AC	250 DC
300	Allis Ch.*	220/440	AC	250 DC
200	Ridgeway*	2300/4000	AC	550 DC
200	Gen.Elec.*	220/440	AC	125 DC
200	Reliance*	220/440	AC	250 DC
150	Gen.Elec.	220/440	AC	125/250 DC
150	Burke*	220/440	AC	250 AC
105	Century b.b.	220/440	AC	70 DC
100	Allis Ch.	220/440	AC	125/250 DC
100	Allis Ch.	2200	AC	250 DC
100	Gen.Elec.*	220/440	AC	125 DC
75	Gen.Elec. (3)	220/440	AC	125 DC
75	Cr.Wh. b.b. (2)	220/440	AC	250 DC
75	Star* b.b. NEW	220/440	AC	50 DC
50	Whse.	220/440	AC	250 DC
50	Gen.Elec. (2)	220/440	AC	125 DC

*Synch. motor drive.

D. C. MOTORS

HP	Mfr	Type	Volts	Speed
200	Reliance	1970T	230	575/750
150	Whse.	SK201	230	300/900
150	Cr.Wheeler b.b.	52H	230	1200
150	Cr.Wheeler b.b.	TEFC	230	800
100	Whse.	SK181	230	450/900
100	Gen Elec.	C	230	575/1000
100	Gen.Elec.	RC36	115	1150
75	Cr.Wh. NEW b.b.	TEFC	230	900
75	Allis Ch.	E-149	230	500
75	Northw'n	K20	230	1750
75	Cr.Wh. NEW b.b.	CMC-HH	230	1150
75	Century	DN	230	850
60	Century	DN	230	1150
50	Cr.Wheeler	FH	230	1750
50	Gen.Elec. b.b.	CDM	115	1150
40/60	Whse. (2)	SK 170	230	500/1000
40	Cr.Wheeler	EH	230	1750
40	Century (2)	DN	230	1150
40	Sprague dyna.	LC	230	750/2000
40	Whse. (2)	SK130	230	950
35/50	Gen.Elec.	CD123	230	575/1150
30	Reliance b.b. (3)	230T	230	850
30	Whse.	SK93	230	1750

D. C. GENERATORS

KW	Mfr	Type	Volts	Speed
200	Reliance	1970T	250	720
180	Cr.Wheeler b.b.	TEFC	250	1200
125	Cr.Wheeler b.b.	52H	250	1200
105	Century b.b.	1500 amp.	70	1200
100	Gen.Elec.	RC17	125	1200
100	Gen.Elec.	C	250	750
100	Allis Ch. 3 wire	MCW	120/	1200
75	Cr.Wh. NEW b.b. (3)	HH	250	1450
75	Allis Ch.	E	250	750
75	Gen.Elec. (2)	RC36	125	1200
50	Whse.	SKg	250	1200
50	Gen.Elec. b.b.	CDM	125	1450

A. C. MOTORS—25 CYCLE

HP	Mfr	Type	Volts	Speed
150	Whse.	HF	440	500
150	Gen.Elec.	IK-16	440	750
80	Gen.Elec. int.	MTC5337	440	750
50	Gen.Elec.	I-K	440	750
50	Gen.Elec.	KT339	440	1500
40	Gen.Elec.	KT343	440	750
20	Gen.Elec.	KT527	440	750

A. C. GENERATORS—60 CYCLE

KVA	Mfr	Type	Volts	Speed
625	Gen.Elec.	ATB	2300	450
375	Gen.Elec.	ATB7567	240/480	1200
300	Gen.Elec.	ATB	240/480	720
250	Whse.	G	2400/480	600
225	Gen.Elec.	ATB	240/480	600
187	Gen.Elec. (2)	ATB	240/480	900
150	Gen.Elec.	ATB	240/480	900
125	Gen.Elec.	ATB	240/480	720
125	Gen.Elec.	ATB	240/480	300
56	Gen.Elec. (2)	ATB	240/480	1200

A. C. MOTORS—SLIP RING

3 Phase 60 Cycle 220 or 440 Volts

Qu	HP	Mfr	Type	Speed
1—	600	Gen.Elec.	I-M	360
1—	500	Allis Ch.	ANY	450
1—	400	Gen.Elec. 2300V.	IM-EB	1800
2—	300	Allis Ch. 2200V.	ANY	720
1—	300	Gen.Elec. 2200V.	I-M	1800
1—	250	Allis Ch. 2200V.	ANY	514
2—	200	Gen.Elec. 2200V.	I-M-16	600
1—	200	Gen.Elec.	I-M	360
1—	00	Gen.Elec. 2200V.	I-M-17A	450
1—	200	Allis Ch. 2200V.	ANY	720
1—	150	Gen.Elec. 2200V.	I-M-16	600
1—	150	Whse.	MW	450
1—	150	G.E. 2200/4000V.	I-M	1200
1—	150	Allis Ch.	ANY	600
1—	100	Gen.Elec.	MT356	900
1—	100	Gen.Elec.	I-M	720
1—	100	Allis Ch.	ANY	1800
1—	100	Allis Ch. b.b. NEW	ARY	600
1—	75	Howell	SR443	1800
1—	75	Cont. b.b. NEW	SN584	1200
1—	75	Gen.Elec.	I-M-E13	1200
2—	75	Gen.Elec.	I-M-14	720
1—	75	Gen.Elec. int. duty	MTC5342	900
1—	75	Gen.Elec.	MT558	600
1—	50	Allis Ch.	ANY	900
1—	50	Howell	SR437	1200
1—	50	Gen.Elec. int.	ITC5013	600
1—	50	Gen.Elec.	I-M	720
1—	40	Gen.Elec. int.	MTC5326	900

A. C. MOTORS—SYNCHRONOUS

HP	Mfr	Type	Volts	Speed
600	Gen.Elec. (2)	TS	2200	514
400	Gen.Elec. .8PF	TS	220/440	1200
300	Gen.Elec.	ATI	220/440	720
300	Whse.	G	2200/440	600
225	El.Machy.	3 brg.	2200	360
220	G.E. 3 brg. .8PF	ATI	220/440	600
200	G.E. .8PF	ATI	220/440	900
190	El.Machy.	3 brg.	220/440	514
150	Gen.Elec.	ATI	220/440	360
150	Gen.Elec. (2)	ATI	220/440	720
100	American b.b.	YGH	220/440	900

- EXPLOSION PROOF MOTORS — New & Rebuilt, all sizes.
- GEARHEAD MOTORS, AC & DC.
- FREQUENCY CHANGERS.
- CIRCUIT BREAKERS, AC & DC.

A. C. MOTORS—SQUIRREL CAGE

3 Phase 60 Cycle 220 or 440 Volts

Qu	HP	Mfr	Type	Speed
1—	400	Whse. 2200V	CS	1800
1—	250	Gen.Elec.	FT549AZ	3600
1—	250	Gen.Elec.	FT549	3600
1—	250	Whse.	CS5954A	720
1—	200	Whse. b.b. NEW	CS875	1800
1—	200	Allis Ch.	AN	1200
1—	150	Gen.Elec. TEFC b.b.	K6333S	1200
2—	150	Howell b.b.	M584	1800
1—	150	Gen.Elec.	I-K-16	600
1—	150	Reliance b.b. NEW	B6085	1200
2—	150	Gen.Elec.	KF557	1200
1—	150	Gen.Elec. TEFC b.b.	K6335	720
2—	125	Gen.Elec.	K5058	1800
1—	125	Reliance b.b. NEW	C5085	1200
1—	125	Allis Ch. 2200V.	AN	1200
1—	125	Gen.Elec.	I-K-16	450
1—	125	Cont. 2200V. b.b.	SC	1800
2—	125	Rel. TEFC NEW	B6085	1800
1—	100	Gen.Elec.	I-K-14	900
5—	100	Allis Ch. 2200V.	AR226	1200
1—	100	Reliance b.b. NEW	C5085	900
1—	100	Rel. TEFC NEW	C5085	1200
1—	100	Gen.Elec. b.b. NEW	K5048	1800
1—	100	Cont. TEFC	NP682	1200
1—	100	Gen.Elec.	I-K-J	720
2—	75	Gen.Elec.	I-K	600
1—	75	Reliance b.b. NEW	C5084	900
1—	75	Reliance TEFC NEW	C5084	1200
1—	75	Reliance b.b. NEW	C505	1800
1—	75	Gen.Elec.	KT329Y	3600
2—	75	Reliance b.b. NEW	C805	1200
1—	60	Al.Ch. 2200V.	AR226C	900
1—	60	Gen.Elec.	KT552	720
2—	60	Reliance b.b. NEW	B504	1800
2—	60	Reliance TEFC NEW	C505	1200
2—	60	Reliance b.b. NEW	C804	1200
2—	60	Whse. H.T.	CS504	1800
1—	60	Wagner b.b.	RP444	3600
1—	50	Allis Ch. b.b.	AR3445	1800
2—	50	Whse. b.b. NEW	CS4084	1800
1—	50	G.E. NEW b.b. HT	KG405	1800
2—	50	Reliance b.b. NEW	C445	1200
2—	50	Gen.Elec.	KT33	1200
1—	50	Gen.Elec.	KT342	900
1—	50	Whse. hoist	WL607	900
1—	50	Whse. b.b.	CS504	1200
2—	50	Gen.Elec.	KT382	600

ARTHUR WAGNER COMPANY

1433 W. RANDOLPH STREET CHICAGO 7, ILL. MONroe 6-7409

IF THERE IS

Anything you want

that other readers of this paper can supply

OR —

Something you don't want

that other readers can use, advertise it in the

SEARCHLIGHT SECTION

FOR SALE

USED BOILERS

3—10,000' American Red Flash heating
1— 30 HP Scotch Marine, 100# hand fired
4— 90 HP locomotive fire box 200#
4—110 HP locomotive fire box 200#
2—150 HP locomotive fire box 150#
1—250 HP B&W water tube 170#
2—150 HP H R T 150#
1—410 HP Heine water tube 200#
1—505 HP Brise water tube 200#
1000 AC 220 Turbine Generator

NATIONAL BOILER & EQUIPMENT CO.

1501 So. Senate Ave., Indianapolis 25, Ind.

FOR SALE

MODERN 1000 KW Turbo-Generator

In Excellent Condition

Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker, and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum, Textile, Pulp and Paper, and Sugar Refining Industries.

NEWMAN & COMPANY, INC.

739 Drexel Building Philadelphia, Pa.

MOTORS • GENERATORS • TRANSFORMERS

200 KW M.G. SET

200 KW Westinghouse NEMA Frame Generator 250 V. DC 1200 RPM direct Connected to
300 HP. Westinghouse Synchronous Motor 3/60 220/440 Volts 1200 RPM.
AC & DC Panels—Like new. Ship now.

MOTORS

60—50—25 CYCLE
In stock—all sizes
Slipring — Squirrel Cage — Synchronous
All types of control equipment.

350 KW GENERATORS

2—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

DIRECT CURRENT EQUIPMENT

125-250 Volt Motors, Generators and M-G Sets with controls.

SLIPRING MOTORS

500 HP Allis Chalmers type ANT-WR 3 phase, 60 cycle, 2300 volt 514 RPM.
100 HP Westinghouse type CW 3 phase, 60 cycle, 220/440 volt 450 RPM.

FREQUENCY CHANGERS

All Sizes in Stock. 60 cycle to 90 cycle, 100 cycle, 120 cycle, 180 cycle and any other high cycle.

ALL ITEMS IN STOCK FOR IMMEDIATE SHIPMENT

NIAGARA TRANSFORMERS

1 Phase — 60 Cycle — New

Stock Shipment on sizes listed. Short delivery on sizes up to 5000 KVA—1 or 3 phase, in voltage ratings to 69 KV. Standard taps. Built to A.I.E.E.—N.E.M.A.—A.S.A. Standards.

LISTING OF TRANSFORMERS

Quantity	KVA	Primary	Secondary
3	15	7200/12470Y	240/480
3	15	2400/4160Y	240/480
3	25	2400/4160Y	120/240
6	25	2400/4160Y	240/480
3	25	7200/12470Y	240/480
3	37½	2400/4160Y	120/240
6	37½	2400/4160Y	240/480
9	50	2400/4160Y	240/480
5	50	2400/4160Y	120/240
4	75	2400/4160Y	120/240
6	75	2400/4160Y	240/480
3	100	2400/4160Y	120/240
12	100	2400/4160Y	240/480
3	167	2400/4160Y	240/480
3	167	2400/4160Y	120/240
6	250	2400/4160Y	240/480
3	333	2400 x 4800	240 x 480
3	500	7200/12470Y	240 x 480

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y. CL. 4758

BREW-WOLTMAN OFFERS

TURBINE UNITS

1—5000 KVA G. E. Non-C. 60 cy. 13200 V. 600-lb.
1—3125 KVA Worthington Non-C. 60 cy. 2300 V. 150-200 lbs., 40 lbs. BP.
1—2500 KVA G. E. Extraction Cond. 60 cy. 480 V. 185-200 lbs. steel valve chest.
1—1563 KVA G. E. Extraction Cond. 60 cy. 480 V. 200-lbs.
1—1250 KVA Allis Cond. 60 cy. 2300 V. 150-200 lbs.
2—1250 KVA Elliott Cond. 60 cy. 480 V. 150-200 lbs. 600' Surface Condenser.
1— 25 KW Allis Non-C. DC 125 V. Exciter. Dual drive turbine & motor.

ROTARIES—60 Cy.

1—2929/3705 KW Gen. Elec. 225/285 V.
1—2160/2700 KW Gen. Elec. 240/300 V.
2—1000 KW Westinghouse 600 V.

DIESEL ENGINE UNITS

3—700 HP Gen. Motors 2300 V. 60 cy. gen.
3—650 HP Amer. Loco. 440 V. 60 cy. gen.
1—600 HP Fair. Morse 2400 V. 60 cy.
1—400 HP DeLaVergne 2400 V. 60 cy.

STEAM ENGINE UNITS

1—312 KVA Skinner Uniflow, 480 V.
1—312 KVA Ames Uniflow, 240 V.
1—250 KVA Ames Vertical Uniflow, 480 V.
2—187 KVA Ames Vertical Uniflow, 240/480 V.

SPECIALS

3—700 HP General Motors Diesel 8 cyl. 4 cy. 360 RPM dir. con. to 485 KW .8 PF 3/60/2300 V. generators.
2—1250 KVA Elliott 3/60/480 V. 3600 RPM generators dir. con. to 150-200 lbs. IP 600° TT turbines with dir. con. exciters surface condensers & pumps.

SYNCHRONOUS MOTORS—60 Cy.

1—4350 HP Cr. Wh. 13800 V. 514 RPM
1— 600 HP G. E. 440 V. 360 RPM
2— 350 HP G. E. 2300 V. 257 RPM
1— 300 HP G. E. 2300 V. 900 RPM
1— 300 HP West. 2300 V. 900 RPM

INDUCTION MOTORS—60 Cy.

1—300 HP. West. S/R 2200 V. 1770 RPM
1—250 HP G. E. S/R 2200 V. 1800 RPM
1—200 HP Cr. Wh. S/C 2300 V. 720 RPM. NEW.
1—200 HP G. E. S/R 2200 V. 435 RPM
1—150 HP Cr. Wh. S/C 440 V. 900 RPM. NEW.
1— 75 HP Al. Ch. S/C 440 V. 900 RPM
3— 75 HP Cr. Wh. S/C 220/440 V. 1200 RPM

MOTOR GENERATOR SETS

2—1500 KW G. E. 600 V. DC 60 cy.
2— 500 KW Cr. Wh. 250 V. DC 60 cy.
2— 300 KW G. E. 250 V. DC 60 cy.
1— 75 KW Star 240 V. DC 60 cy.
1— 75 KW West. 125 V. DC 60 cy.

MERCURY ARC RECTIFIERS

2—4500 KW Multi Anode 600 V. DC
2—3250 KW Ignitron 650 V. DC

FREQUENCY CHANGERS

1—2500 KVA G. E. 25/60 cy. 300 RPM
1—1250 KVA West. 25/60 cy. 300 RPM
3—1000 KVA G. E. 25/60 cy. 300 RPM
1— 500 KVA Al. Ch. 25/60 cy. 300 RPM

TRANSFORMERS—60 Cy.

1—7500 KVA	G. E.	138000—41000, 3 ph.
1—4500 KVA	G. E.	66000—33000, 3 ph.
3—1000 KVA	West.	66000—7200
1—5000 KVA	West.	34500—13750, 3 ph.
1—5000 KVA	G. E.	33000—2300/4000, 3 ph.
3—667 KVA	G. E.	33000—2300/4000
6— 75 KVA	Moloney	33000—2300/6800
6— 50 KVA	G. E.	33000—2300
3—3750 KVA	West.	26400/13200—2400
4— 450 KVA	Al. Ch.	25410/44000—13200/23000
1—7500 KVA	G. E.	13800 Rectifier type
3— 333 KVA	G. E.	13200—2400/4160 Y
3— 750 KVA	West.	13200—440
3— 200 KVA	Moloney	11000—2300
3— 167 KVA	G. E.	7200/12600—240/480
1—1500 KVA	West.	4000—2300, 3 ph. Auto
3— 250 KVA	Al. Ch.	2300—460

OIL CIRCUIT BREAKERS

1— 600 A. 73 KV	G. E. FHKO-139	Outdoor
1— 400 A. 37 KV	G. E. FHKO-136-CS	Outdoor
1— 400 A. 37 KV	Condit FO-40-8	Outdoor
1—1200 A. 34.5 KV	G. E. FKO-339-1000	Outdoor
4—2000 A. 23 KV	G.E. FKO-339-1000	Outdoor
4— 600 A. 15 KV	G. E. FHKO-136BS	Outdoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW-WOLTMAN & CO., INC.

50 Church Street New York City 7, WOrth 4-1470

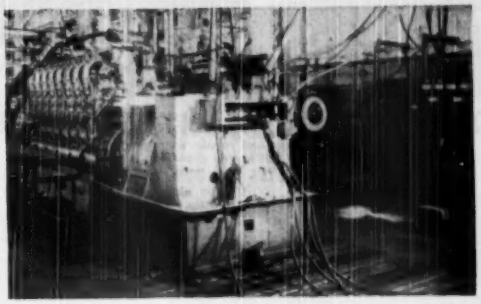
DIESEL POWER

AT 40% TO 60% SAVINGS

EACH ENGINE "REMANUFACTURED"
AND "FULL-LOAD TESTED"
PRIOR TO SHIPMENT

INSPECTION INVITED

ALL EQUIPMENT OFFERED WITH ONE YEAR GUARANTEE



VIEW OF ENGINE TEST STAND FACILITIES AT OUR PLANT IN SAUSALITO (S.F.) CALIF. ALL ENGINE TESTING CONFORMS TO DIESEL MANUFACTURERS' STANDARD METHODS.

A PARTIAL LIST OF OUR INVENTORY

KVA	MAKE	MODEL	HP	RPM	KVA	MAKE	MODEL	HP	RPM
1875	Fairbanks Morse	33E16	2000	300	312.5	Clark	MD-4	375	327
1420	Fairbanks Morse	38D	1600	720	300	Fairbanks Morse	YVA	360	257
1250	General Motors	16-278A	1600	720	250	General Motors	8-268A	350	1200
1000	General Motors	12-278A	1200	720	200	Buckeye	80	240	600
937.5	General Motors	12-567	1080	720	187.5	Ingersoll Rand	S	225	514
625	Alco	6-12½x13T	750	600	156	Buckeye	E	190	400
425	Baldwin	VO	510	450	125	General Motors	3-268A	150	1200
400	Buckeye	80	480	600	121	Fairbanks Morse	32E14	140	300
375	Enterprise	DSG-6	450	450	75	General Motors	6-71	90	1200
330	Superior	KNA	396	514	62.5	Int'l Harvester	UD-18	76	1200
312.5	General Motors	8-268A	450	1200	50	General Motors	4-71	60	1200

A. G. SCHOONMAKER COMPANY, INC.

52 CHURCH STREET, NEW YORK 7, N. Y.

SHOPS AND WAREHOUSE: JERSEY CITY, N. J. AND SAUSALITO (S.F.) CALIFORNIA

two 100 KW 250 Volt DC Generators. Steam driven by Ball Engines—140# pressure.

one 200 KW 250 Volt DC Generator. Steam driven by Ball Engine—140# pressure. Units complete with DC switchboard and two balancer sets.

one 20 ton York Vertical Ammonia Compressor. Steam driven by Corliss Engine—140# pressure.

one 15 ton York Vertical Ammonia Compressor. V belt drive. 33 H.P.— DC motor. Complete with condenser, receiver, valves, gauges, etc.

PURITY BAKERIES

97 E. 12th Street St. Paul 1, Minn.

DIESEL GENERATORS

Three 200 K. W. GENERATORS G. E., 2300 v. , 3 phase, 60 cy. with three 300 H.P. UNION DIESEL ENGINES, 6 cyl., 12" bore, 17" stroke, 277 R.P.M. *Factory rebuilt.*

GEORGE M. ACKER CO.
3833 WILSHIRE BLVD.
LOS ANGELES 5, CALIF.

DIESEL GENERATOR PLANTS

COMPLETE WITH SWITCHBOARDS

1000 KW to 100 KW
STATIONARY and PORTABLE
AT GREATLY REDUCED PRICES
NEW UNIT GUARANTEE

HERCULES ELECTRIC MACHINERY and EQUIPMENT CO.

Tel. NEvada 6-2808
Cable Address HEMCOY

1412 So. Alameda Street
Compton, Calif.

STEEL STORAGE TANKS

2—1000 & 2—10,000 Bbl. New Vertical
6—74,000, 55,000 & 37,500 Bbl. Vert.
8—25,000 Gal. Cap. Horizontal
50—10,000 & 3—20,000 Gal. Horizontal
6—10,000 & 12,000 & 16,000 Gal. ⅜" Shell
20—10,000 Gal. Cap. 60 lbs. Press. Test

L. M. STANHOPE, Rosemont, Penna.

SELLING FOR CUSTOMERS

1500 KW 4000 V Allis Chalmers Cond turbine 200 lb. S lb. G. P.
300 KW 240 V Westinghouse geared Noncond. turbine
400 KW 480 V 1200 RPM Elliott generator with 1200/4500 gear.
285 KVA 240 V Chase outflow engine set.
2000 Amp. 3-pole GE Air breaker with Bus Duct.
300 & 200 KW Spec M G. Set with control.

H. BLANE JOHNSON & ASSOCIATES
53 W. JACKSON BLVD., CHICAGO 4, ILL.

THE HOME OF VALUE AND QUALITY FOR . . .

ELECTRICAL POWER EQUIPMENT

WE CARRY A COMPLETE STOCK OF . . .

QUALITY GUARANTEED "REBUILTS"

Our facilities for rebuilding and repair work are the finest in the nation and are supplemented by a staff of thoroughly experienced engineers.

HERE'S A PARTIAL LIST OF OUR HALF MILLION DOLLAR STOCK

SLIP-RING MOTORS

3 phase, 60 cycle—220 or 440 volt (*2200 volt or higher)

H.P.	Make	Type	Speed
2000	*G.E.	MT	257
2000	*G.E.	MT-30	240
1250	*G.E.	M	720
1200	*G.E.	MT-26	277
800	*Westg.	CW	567
650	Westg.	HF	360
500	Westg.	CW	360
500	Westg.	CW	450
400	G.E.	IE	1800
300	*G.E.	IE15A-4	1800
300	G.E.	IM-17	1200
250	Westg.	CW-32B	900
250	Westg.	CW	600
200	G.E.	IM	600
150	Al. Ch.	ANY	600
100	G.E. NEW	M63332	900
100	G.E. NEW	M6334	720
100	Westg.	CW-856C	600
100	G.E.	IM-15A	450
75	G.E.	IM-E-14	1800
75	Westg.	CI-756A	600

SQUIRREL CAGE MOTORS

3 phase, 60 cycle—220 or 440 volt (*2200 volt or higher)

H.P.	Make	Type	Speed
750	G.E.	KT	720
500	G.E.	KTP-587	1200
400	*Al. Ch.	ANW	900
300	G.E.	PT-559A	1800
250	Westg.	CS-956A	600
200	Reliance	AA-C6058	1200
200	*G.E.	IE-15-K	600
150	Westg.	CS-771	1800
150	G.E.	IE-13AK	1800
150	G.E.	IE-13B	1200
150	G.E.	1-15-S	900
150	Westg.	CS-950A	600
125	G.E. TEFC	K-6326S	1200
125	G.E.	KT-558	900
100	U.S.-Vert.	CFU-994-A	1200
100	Burke	EM-12.5	1200
100	G.E.	K-6333	720
75	*Al. Ch.	AR-223BS	1800
75	Westg.	CS-505-S	1800

SYN. A. C. MOTORS

3 phase, 60 cycle—220 or 440 volt (*2300 volt or higher)

H.P.	Make	Type	P.F.	Spd.
1000	*Westg.	SC-3D358	.8	900
700	*G.E.	ATI	.8	720
450	El. Ma.		1.0	240
320	*Al. Ch.	Dr. Prf.	1.0	720
250	*Al. Ch.		1.0	720
200	*Al. Ch.		1.0	360
150	G.E.	ATI	.8	600
125	G.E.	TS-954B	1.0	1200
100	Cr. Wh.	103-S	.8	900
100	G.E.	ATFI	.8	900

A. C. GENERATORS

3 phase, 60 cycle—220 or 440 volt (*2300 volt or higher)

1000	*Westg.	863D	.8	900
725	*G.E.	ATI	.8	720
250	*Al. Ch.		.8	720
156	G.E.	ATI	.8	600
125	El. Ma.	EM	.8	720
112	G.E.	759548	.8	1200
110	*Cr. Wh.	103-S-8	.8	900
100	*G.E.	ATI-8	.8	900

BOILERS

507 HP Comb. Eng. water tube 400#
404 HP Sprgfld. sec. head, 200#
400 HP B.&W. bent tube, 200#
300 HP B.&W. Sec. head 200#

MOTOR GENERATOR SETS

K.W.	Make	A.C.	D.C.
1000	G.E.	4600	375
500	G.E.	2300	230
500	G.E.	440	230
500	G.E.	4000	1200
450	G.E.	2300	235
200	Cr. Wh.	2300	120
200	G.E.	440	235
150	Al. Ch.	220	120
100	G.E.	400	250
75	Star	440	230
75	G.E.	440	250
60	Al. Ch.	2300	115
60	Fr. Morse	220	130
50	Westg.	220	110
40	Cr. Wh.	220	125
20	G.E.	440	250
20	G.E.	440	125
15	Ideal	220	125
10	Cr. Wh.	220	125
10	Ideal	220	125

LOW VOLTAGE—M. G. SETS

Amp.	Make	A.C.	D.C.
1500	Chandyn	440	60
1500	G.E.	2300	60
1000	Chandyn	440	40
333	Columbus	440	45

TURBINE SETS—A. C.

KVA	Make	Press.	Volt
1800	Gen. Elec.	400-C	2300
1250	Gen. Elec.	750-NC	2300
625	Al. Ch.	140-C	480
312	Moore-C.W.	425-C	480
25	Elwal-C.W.	150-NC	240

D. C. MOTORS—230 V.

H.P.	Make	Type	Speed
250	G.E.	MFC-6A	730/875
150	G.E.	RC-39A	600
100	Al. Ch.	E-182	575/1150
100	West. Elec.	RC-34	2500
75	G.E.	RC	1200
60	Westg.	SK-133	1200
40	Roth	FR-50	696
40	G.E.	RC-34A	756
40	Al. Ch.	B-131	850
35	Cr. Wh.	CM-381	700
35	Sprague	C	800
30	Westg.	SK-130	975
30	Sprague	C-69	850
30	Cr. Wh.	CCM-50H	450
25	Westg.	SK-100L	1100
25	Al. Ch.		700
25	Westg.	S-9	500
20	Westg.	SK-83	1800

D. C. VARI-SPEED—230 V.

500	G.E.	MPC	160/ 250
325	Westg.	QM	450/ 900
230	G.E.	MPC	730/ 900
125	Reliance	1050T	600/1800
100	Al. Ch.	E-182	525/1150
60	Westg.	SK-170	525/1000
60	Nat.		250/1000
25	Sprague	C-69	300/ 900
30	Westg.	SA-8	500/1500
30	Westg.	SA-12	400/1200
25	G.E.	CD-105	500/1500
20	Al. Ch.	B-145	500/1200
15	Reliance	185T	400/1600
15	G.E.	CD-150	400/1600

HOISTS

3 phase, 60 cycle, 220 or 440 volt

Cap.	Make	Lift	Design
6000	Shaw Box	27	Lo-head
6000	Shaw Box	17	Std.
4000	Yale	17	Lo-head

2 COMPLETE VARI-VOLT DRIVES

M.G. Set, 260 K.W., D.C. gen., Elec. type MPC, 250 volts, 890 amps. 1200 RPM. dir. conn. to 300 HP syn. motor, Gen. Elec. type TS, 3 ph. 60 cy. 440 volt, .8 PF. 1200 RPM.

D.C. Meter, 250 HP, Gen. Elec., type MPC, 245 volts, 730/875 RPM, with complete starting and control panels.

1000 K.W. Gen. Elec., type MPC, about 325 volt, 3840 amp. direct connected to 1120 KVA Gen. Elec. type TS, 3 ph. 60 cy. 4000 volt, 141 amp. .8 PF. 514 RPM. on fab. sub-base 250 volt fields bus excited.

750 K.V.A. DRY TRANSFORMERS

6—750 KVA. Westinghouse air cooled Class B, wdg. 13,800 V. pri. to 460 V. sec. 3 ph. 60 cy. 4—2½% taps.

CHICAGO ELECTRIC

Carries a complete stock of "rebuilts" in:

- AC MOTORS
- DC MOTORS
- GENERATORS
- M. G. SETS
- TRANSFORMERS
- SWITCHBOARDS
- COMPRESSORS
- HOISTS
- PUMPS

PHONE

CAnal 6-2900

TODAY

First Source for 40 Years for Quality Electrical Equipment

CHICAGO *Electric Co.*

1320 W. CERMAK RD. • CHICAGO 8, ILL.

COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

"Export Orders Carefully Executed"

BOILER UNITS

1—140,000# New Steam Generator 600#, also Super
2—60,000# Boilers, 625#, 823° F.t., Economizer and Air-heater
2—60,000# B&W 450# superheat
3—30,000# B&W 450# superheat
1—1000 HP Erie City Boiler, 200#
1—1000 HP Vogt 300# with Super
6—600 HP Each Bent tube type 200#, superheat
3—500 HP Stirling type Boilers, 450# superheat
2—500 HP B&W Sectional Header 200# Boilers
2— 300 HP Straight Tube 200# Boilers
Also smaller Boilers & Fire Tube Boilers

TURBO UNITS

1—10,000 KW. Extraction type, send. 600#
1—10,000 KW Turbo-Generator—Cond.
1— 7,500 K WTurbo-Generator—Cond. 600#
1— 7,500 KW Turbo-Generator, Cond.
1— 3,000 KW Turbo-Generator—Cond.
2— 3,000 KW & 2—2500 KW Cond.
2— 2,000 KW same as above
2— 1,500 KW same as above } Also 400# & 600# turbos
2— 1,250 KW same as above
2— 1,000 KW same as above
1—500 KW same—Also 750 KW & 300 KW Units
Non-Cond. :—300—500—750—1000—1500—2000

Complete Steam Plants with 2—1250 KW; 2—2500 KW; 2—3000 KW & 7500 KW
Frequency Changers—Transformers! Send us your requirements—We may have it.
Send us your INQUIRIES for ALL POWER MACHINERY

CHARLES B. REARICK — 30 CHURCH ST. — NEW YORK 7, N. Y.

Steam Power Plant Equipment

2—500 HP Straight Tube W.T. Boilers 165# Press, Detroit U.F. Stokers
1—Nordberg Uniflow Engine, 18x24 direct connected to A-C Generator 200 KW 240/3/60
1—Filer & Stowell 24x42 Corliss 100 RPM with 12 ft. x 41 in. Belt Wheel
100 ft. 3 ply 38 in. Leather Belt like new
2—Duplex Steam B.F. Pumps

Plant can be seen in operation until July 1, 1950.

We also have the following equipment for sale:

3 Oil Switches
Condit Electrical Mfg. Co.
Boston, Massachusetts
Type D17A Max Volts 15,000
400 AMPS
3-200 KVA—60 cycle 1 Phase
Polarity SUB—Pri Volts 3810
See Volts 244-488
GE Type H Form C. P.
Rebuilt by WN Abbertson & Co. Inc.
Ser. #554242, 554243, 554244
Westinghouse Static Condenser
Type L.D.
Normal Operating Volts 4000
Max Sustained Volts 4400
Normal K.V.A.—180
Maximum K.V.A.—218
60 cycle 3 Phase S.O. 33C808
32 Capacitors Type L D 5 K.V.A. Style #420525
3 Westinghouse Current Transformers Type KA 50 VA 50-5 AMPS. Comp. for 25 VA
8900 V. 25-133 cycle Style 180643A
Westinghouse Hand Operated Oil Circuit Breaker Style 296783B

J. GREENEBAUM TANNING CO.
4763 N. 32nd St., Milwaukee 9, Wisc.

M. G. SET: G. E., 3 phase, 60 cycle, 220 volt, 20 H.P., D.C. Generator, 12 KW, 125 volt, with push button compensator.

MOTORS: 2—NEW 1000 H.P., 3 phase, 60 cycle, 2200 volt, complete with automatic control equipment.

TRANSFORMERS: 2—2500 KW, 3 phase, 60 cycle, 66,000 to 2300 volts. A complete Sub-Station.

COAL PULVERIZER: NEW, UNUSED, Babcock & Wilcox, capacity 7500 lbs. of coal per hour, 125 H.P. motor, complete.

HAMMER MILL: Jeffrey 24 x 36", type B-3, roller bearings, V-Belt, NEW condition.

A. J. O'NEILL
LANSDOWNE, PA.
Phila. Phones. Madison 3-8300—3-8301

HYDRO-GENERATOR FOR SALE

1000 KVA hydraulic turbo-generator, modern design, good condition, 3 phase, 60 cycle, 2300 volts for 147 foot head, 450 R.P.M., any reasonable offer. Will divide. In storage California.

FS-6407 POWER
330 W. 42nd St., N.Y.C.

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

Holly Gravity Return System
Steam Boilers and Accessories

RUSSELL B. HOBSON and SONS
GREAT NOTCH NEW JERSEY

POWER EQUIPMENT—READY TO SHIP

A.C. MOTORS—3 PH. 60 CY.

No.	HP.	Make	Type	Speed	Volts
1 NEW	300	West.	SYN	1200	220/440
1	250	Burke	SYN	720	2200
1 vert	250	G.E.		1175	2200
1	200	G.E.	I	860	2200
1	200	G.E.	SYN	1800	2200/550
1	175	West.	MS	1200	220/440
1	150	West.	SYN	257	220/440
1	150	West.	SYN	600	220/440
1	150	West.	SYN	900	2200
1	150	G.E.	I-K	1200	2200/220/440
1	150	West.	MS	1200	220/440
3	150	Louis Allis	FX	1750	220/440
4 NEW	125	West.	SYN	1200	220/440
1	125	G.E.	I-K	900	220/440
1 NEW	125	Elec. Mach.		580	2300/440
1	125	Elec. Mach.	SYN	164	220/440
1	125	West.	TEFC	3600	220/440
1	112	West.	SYN	1200	220/440
1	100	Reliance	IT	495	220/440
1	100	G.E.	I	720	220/440
1	100	Al. Chal.		720	220/440
1	100	G.E.	I-K	900	220/440
1	100	G.E.	I-K	900	2200
1	100	West.	SYN	900	220/440
1	100	Cr. Wh.	SC	1100	2200/220/440
1	100	Louis Allis	OGS	1750	220/440
1 NEW	75	Al. Chal.	AR	865	220/440
1	75	Al. Chal.		580	220/440
1	75	West.	CS-877C	660	220/440
1	75	G.E.	I-K	600	220/440
1	75	G.E.	I-K	720	2200
1	75	G.E.	I	720	220/440
1	75	Louis Allis	OGB	1200	220/440
1	75	Burke		1200	220/440
1	75	Louis Allis	FAA-505Y	1150	220/440
2	75	West.	CS (TEFC)	1750	220/440
1	60	Al. Chal.		515	220/440
1	60	G.E.	I-K	600	220/440
1	60	Cr. Wh.	SC	720	220/440
5 NEW	60	West.	CS-607 (EXPLOSION PROOF—TEFC)	900	220/440
1	60	Elec. Dyn.	drip pr.	3600	4000/2300
2	50	G.E.	KT-346	720	220/440
2 NEW	50	Reliance (TEFC)	B-504-S	1750	2200
8 NEW	50	G.E. (TEFC)	K-504	1750	2300
1 NEW	30	West.	CS-445 hi-torq	900	220/440

VARIABLE SPEED MOTORS—230 V. D.C.

HP	Make	Type	Rpm
100	West.	SK-190	500/1000
75	Louis Allis	F-210	400/1200
60	Louis Allis	F-210	400/1200
50	West.	SK-170	250/1850
50	West.	SK-153	600/1200
40	Elec. Gen.	180-S	385-1200
30	West.	SK-130	975/1750
30	G. E.	DLC-50	400/1200
30	West.	SK-130	725/1450

SPECIAL BARGAINS
Diesel Engine Generator Sets

10—100 kw., 120/240 v. D.C. Delco Generators dir. con. to 150 HP Model GBD-8, 5½x7, 6 cyl. Superior DIESEL Engines, elec. start with engine panels

4—100 KW same as above with 220 or 440 v. NEW A.C. Generators

1—63 kva., 120/208 v. 3 ph. 60 cy. 1800 rpm., driven by Cat. DIESEL mtd on trailer

1—96 kva Fairbanks Morse 220/440 v. 3 ph. 60 cy. 360 rpm DIESEL

1—75 KW 220/440 v. 3 ph. 60 cy. International GASOLINE

2—75 kva. 220/440 v. 3 ph. 60 cy. Delco Cummins DIESEL

1—62 kva Fairbanks Morse 220/440 v. 3 ph. 60 cy. 1200 rpm DIESEL

2—37½ kva., 220/440 v. 3 ph. 60 cy. Buda DIESEL

10—NEW 37½ kva., 220/440 v. 3 ph. 60 cy. LeRoi Gasoline

1—31.3 kva. 120/208 v. 3 ph. 60 cy. G.E. Gen. driven by LeRoi GASOLINE

11—NEW 25 kva. 120/220 v. 1 ph. 60 cy. Le Roi GASOLINE

3—25 KW BRAND NEW Onan 220/440 v. 3 ph. 60 cy. 1800 rpm GASOLINE

1—12½ kva. 120/240 v. 1 ph. 60 cy. 1200 rpm., dir. con. Hercules GASOLINE

2—12 kva 120/240 v. 1 ph. 60 cy. Le Roi GASOLINE

2—1½ kw. 120/208 3 ph. 60 cy. Buda GAS.

SLIP RING MOTORS—3 ph. 60 cy.

HP	Make	Rpm	Volts
600	Ideal	1770	220/440
500	Ideal	1770	220/440
400	Ideal	1770	220/440
250	Crocker Wh.	600	220/440
75	G.E.	450	220/440
60	G.E.	570	220/440

A. C. GENERATORS—3 ph. 60 cy.

No.	Kva	Make	Rpm	Volts
6 NEW	100	West.	1200	220/440
10 NEW	37½	West.	900	220/440
3	25	Onan	1800	220/440
11 NEW	25	West. (1 ph.)	900	220/440

M.G. SETS—"SPECIALS" READY TO SHIP

250 kw. West. 125/250 v. D.C. 2300/4600 v. 3 ph. 60 cy. 1200 rpm. Syn.

250 kw. West. 250 v. D.C. 1200 rpm., 380 HP. Syn. Motor 2300/4600 v. complete with switch.

200 kw. West. 125/250 v. D.C. 3 wire 220/440 v. A.C. Syn.

200 kw. West. 250 V. D.C. 1200 rpm., dir. con. 290 HP. 220/440 v. 3 ph. 60 cy. Syn. Motor. A.C.

2—7½ kw. 120/208 3 ph. 60 cy. Buda GAS.

MOTOR GENERATOR SETS—250 V.D.C.
Motors 220/440 volt or 2200 volt 3 phase, 60 cycle

No.	KW	Make	Rpm
3	350	Westinghouse	1200
1	200	Westinghouse	720
2	200	Westinghouse	1200
1	100	Westinghouse	700
1	100	General Electric	900
1	100	Westinghouse	600
1	100	General Electric	1800
1	100	Reliance	580
1	100	Delco	1200
4	75	Westinghouse	720
1	75	Westinghouse	1200
1	60	Westinghouse	1200
3	40	Westinghouse	900
3	30	Westinghouse	720

125 V. DC M.G. Sets

1—100 kw. G.E. 125 v. 900 rpm. 220/440 v. 3 ph. 60 cy. AC Syn.

1—75 kw. West. 125 v. 1200 rpm. 220/440 v. 3 ph. 60 cy. Syn.

TRANSFORMERS—1 ph. 60 cy.

No.	Kva	Make	Pri.	Sec.
1	500	Standard	2300	575/460/345 230/115
3	500	G.E.	2300	220/440
6	333	Maloney	2300	230/460
3	200	G.E.	2300/4000	230/460
3	150	West.	3460/4160	240/480
3	150	Pgh.	2300	230/460
1	100	Peerless	2300	230/460

NEW DIESEL ENGINES

4—HERCULES, 6 cyl. with power takeoff, max. 135 hp. @ 2600 rpm min. 60 HP @ 1200 rpm.

VENTILATING FANS—Bargains

25—BRAND NEW 6000 cfm 3" stat. Pres. Sturtevant Ventilating with 5 HP., TEFC West. A.C. Motors 220/440 v. 3 ph. 60 cy.

GASOLINE FORK LIFT TRUCK

1—Clark Trucklift 48" lift.

BRAND NEW TURBO SET

Westinghouse Steam Turbine consisting of 200 kw., 220/440 v., 3 ph. 60 cy., 1200 rpm., 80% P.F. A.C. Generator—40 kw., 120 v. 1200 rpm., D.C. Exciter and Westg. Reduction Gear.—Non-cond.

SPECIAL BARGAIN AIR COMPRESSOR

6—240 CFM Westinghouse type 3 V8-23 3 cyl. vert., 150 lbs. pres. dir. con., to 50 HP., 220/440 or 2200 v. 3 ph. 60 cy. West Slip Ring Motors, auto. control. Can furnish D.C. Motors or Oil or Gasoline Engines if desired.

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US.

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

MOTORS, M-G SETS
GENERATORS
TRANSFORMERS
FREQ. CHANGERS
CONTROL EQUIPMENT

ALL SIZES, ALL TYPES, ON HAND, in our large and varied stock. QUICK DELIVERY.

EMPIRE
ELECTRIC COMPANY, INC.
87-93 Jay St. • Brooklyn 1, N. Y.
Telephone: MAin 4-5900

DIESEL POWER PLANTS
FOR IMMEDIATE DELIVERY

6—Complete Diesel Generator Power Plants. 125 KVA Worthington BB5, 600 RPM, 3/60/230 or 460 V. with Evaporative Condensers, Air Compressor, Switchboard, and Silencers. New 1943. Test run only.

1—60 KW, G.M. 6-71RC, 3/60/127/220/440 complete. Used only 100 hours.

1—100 KW, Hercules DNX6, 3/60/127/220/440. Unit completely enclosed.

(This Is Only a Partial Listing of Our Inventory. Send Us Your Inquiries.)

Heat and Power Co., inc.
70 PINE STREET · DIGBY 8-0373 · NEW YORK 5, N. Y.

BOILERS
10 to 1000 H. P.
NEW-USED RECONDITIONED
Steam, Gas and Electric Power Equipment
J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-6547-8-9

SPECIAL TRANSFORMERS — YOUR SPECIFICATIONS

NEW TRANSFORMERS
OIL COOLED
AIR COOLED
PHASE CHANGERS

ARROW TRANSFORMER CO., INC.
1932 E. Westmoreland St., Philadelphia 34, Pa.
GArfield 5-0433

USED TRANSFORMERS
REWOUND
REBUILT
RECONDITIONED

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
600	2200	G.E.	1800
500	2200	G.E.	450
450	440/220	Whse.	514
250	2200/440	Whse.	600
200	440/220	Whse.	900
200	2300/440	G.E.	1200
200	440	G.E.	450
150	440/220	Whse.	600
150	440/220	Whse. (2)	1800
150	2200/440	G.E.	1200
150	440/220	G.E.	720
100	440/220	G.E.	600
100 (2)	440/220	Whse.	900
100	2200/550	G.E.	1800
30	440/220	G.E. (MTC)	900
75	2200/550	G.E.	1800

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/440	G.E.	TS	720
300	440/220	G.E.	ATI	900
250	440/220	Whse.	HR	277
250	440/220	G.E.	ATI	600
250	4000/2300	El. Mchy.	Syn.	900
240	2300/440	G.E.	ATI	720
200	440/220	G.E.	TS	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2200/440	Whse.	GE	600

GENERATOR SETS

1—62½ kva, 1200 rpm, 220 volt, Whse., geared to 7300 rpm, Whse., non-cond. steam turbine, 150 lbs. pr.
2—unused 25 kva, 120/280 v., 3 ph., 1200 rpm, generator dir. conn. to Waukesha 6 cyl. gas engine

TURBO-GENERATOR

Generator, 62½ kva, 1200 rpm, 440/220 V., Whse., geared to 50 kw, 7300 rpm, non-condensing.

CIRCUIT BREAKERS

2—2000 amp., GG E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse., 3 pole, 600 v., air

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
650	440	G.E.	FT	3600
500	2200	Cr. Wh.	SC	1800
500	440/220	G.E.	IK	900
350	2200	G.E.	KT	1200
300	2200	G.E.	FT	3600
300	2200	G.E.	KT	1800
250	2300/440	L. Allis	OGS	1200
200	440	G.E.	IK	514
200	440/220	Whse.	CS	1200
200	440/220	G.E.	KT	1800
200	2200/440	G.E.	KT	720
200	2200/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
200	440/220	G.E.	IK	450
150	440/220	G.E.	IK	450
100	2300/550	Whse.	CS	900
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
150	440/220	G.E.	IK	514
150	440/220	Whse.	CS (NEW)	900
100	2200/440	G.E.	K	1200

A. C. GENERATORS

1—320 kva, 600 rpm, 2300/440/220 V., G.E.
1—250 kva, 720 rpm, 2300/440 v., G.E.
1—225 kva, 600 rpm, 220/440 v., G.E.
1—325 kva, 720 rpm, 2300/440 v., G.E.
1—150 kva, 900 rpm, 480/240 v., G.E.
3— 75 kva, 1800 rpm, 480/240 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
350	230 (2)	G.E.	CD	1150
250	230 (3 new)	Cr. Wh.	CMC	1800
200	230	Cr. Wh.	CMC	890
150	230 (new)	Cr. Wh.	TEFC	900
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	SK	850

MOTOR GENERATOR SETS

1—300 kw, 1200 rpm, 250 v., G.E., connected to 500 hp, 1200 rpm, 2300/440 v., synchronous
1—165 kw, 1200 rpm, 240 v., G.E., conn. to 250 hp, 1200 rpm, 440/220 v., squirrel cage
1—100 kw, 250 v., Hertner, 1200 rpm, connected to 150 hp, 2200/440 v., synchronous
1—90 kw, 1200 rpm, 250 V., G.E., connected to 135 hp 2200/440 V. squirrel cage motor
1—75 kw, 125 v., 1200 rpm, G.E. conn. to 120 hp, 2200/440 v., syn. motor.
1—50 kw, 250/125 V., 1200 rpm, 3-wire, G.E., conn. to 75 hp, 440/220 V., sq. cage

TRANSFORMERS 60 Cy.

3—667 kva, Whse., 33,000—2300 V.
3—333 kva, G.E., 13,200—2300 V.
3—833 kva, Whse., 2400—480/240 V., Dry
3—250 kva, G.E., 6900/13,800—230/460 V.
3—200 kva, Whse., 13,200—2300 V. (Inerteen)
6—150 kva, Al. Chal. 2400—240/120 v.
1—150 kva, Whse, 8K, 13200-125/215 v., 3 ph
2—100 kva, G.E., 4600/2300—230/460 V
3—100 kva, G.E., 13800—230/115 v., NEW
6—100 kva, G.E., 4600/2300-230/115 v., NEW
3—100 kva, G.E., 450-115/230 v., dry, 1 ph, new
2—75 Kva, G.E., 480—240/120 v. Pyranol
3—50 kva, G.E., 480—240/120 V., Pyr

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

POWER PLANT EQUIPMENT

SPECIAL OFFERINGS

TURBO-GENERATORS

1—New 15,000 KW 15,800 V. 0.80 P.F. Cd.
2—New 4000 KW 4160 V. 0.80 P.F. Cd.
1—3500 KW 550 V. 200# Cd.
1—2500 KW 550 V. 250# Cd.
2—1800 KW 2300 V. 400# Cd.
2—1000 KW 2300 V. 200# Cd.
2—1000 KW 480 V. 180# Cd.
1— 750 KW 480 V. 150# NC.
1— 750 KW 240 V. 150# Cd.
1— 750 KW 550 V. 170# EX.
1— 465 HP Turbine 900#

BOILERS

2—50,000# 300#
1—30,000# 400#
1—623 HP—450#
2—500 HP—200#
1—487 HP—200#
2—250 HP—125#
2—220 HP—160#
1—72" HRT 150#

DEAERATING HEATERS

3—90,000# Pr. Hr.

ENGINE GENERATORS

1—500 KW 2300 V. Unif.
1—375 KW 2300 V. Unif.
1—168 KW 220 V. Unif.

DIESEL GENERATORS

2—800 KW—2300 V.
2—200 KW—480 V.

COMPRESSORS

33,330 CFM—Cent. 7#
4900 CFM—Gas 50#
1700 CFM—100#
500 CFM—Diesel (2)

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

THE BUYERS MUST BE SATISFIED—ALWAYS

450 HP ENTERPRISE DIESEL

Model DSG-6, 6 Cylinder, 4 Cycle 450 RPM, air start, solid injection Engine. Unused.

Other sizes in stock.

ALJOHN DIESEL CO., INC.
904-10 Pacific St. Brooklyn 16, N. Y.
STerling 3-6515

FOR SALE

Dean Hill 20" nickel cast iron case bronze fitted #303 S.S. shaft centrifugal pump direct connected to 200 H.P. Westinghouse 690 r.p.m. explosion proof motor, 60 cycle, 2200 V. 3 phase. 12,000 G.P.M. @ 54' head. Sell together $7,500 or pump @ $950, motor at $1,550. Dealer inquiries invited.

A. C. GUSTAFSON
2105 McKINNEY, HOUSTON 3, TEXAS

-TRANSFORMERS-

BOUGHT AND SOLD

We carry a large stock of transformers, and invite your inquiries.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.

One Year Guarantee.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 27, OHIO

FOR SALE

Bargain, complete Diesel Power Plant for cheap and emergency power, consisting of 200 and 75 KW; 3 ph.; 60 cy.; 2400 v. units. Fairbanks Morse Modern Unit; Engineering service available.

Diesel, 521 K of P Bld., Indianapolis Ind.
Tel. Lincoln 4967

FOR SALE

1—Chapman Bi Polar Armature and Coil Winding Machine Style 3, Ser. #547, New in 1944. Complete with variable speed AC Motor. Will accept any reasonable offer.

H. P. MANDEL & SONS
2840 S. KEDZIE AVE., CHICAGO 23, ILLINOIS
Bishop 7-7890

DYNAMOMETER FOR SALE

900 HP Midwest Dynamatic Dynamometer, 250 Volts, 1500-3500 RPM, Type 2025-W, Serial No. 2200. Unused w/Toledo Scale, Controls, Etc.

PRICE $2,750.00

PRACTICALLY NEW

WINSTON MACHINERY CO., INC.
517 South Delaware St., Indianapolis 4, Indiana

The Stephen A. Douglass Co.

have condensing type

TURBO-GENERATORS

in complete units,

Capacities 500 KW to 10,000 KW

CAPITAL COST LOW

Current cost per KW LOW

? *On What Capacity Unit Shall We Quote You* ?

Can Supply Boilers Also.

630 Fort Washington Ave., N. Y. 33, N. Y.

FOR SALE

300 KW 220 DC Elliot Turbine Generator in A-1 condition.

WILLIAM L. MARTIN, II, Trustee
Box 476, Bridgeton, New Jersey

1—New General Electric Generator 900 KW, 3 phase, 50 cycle, 5800 or 10,000 Volts, direct connected to Fairbanks-Morse 600 RPM Diesel Engine. Can demonstrate the unit running.

SUNDFELT EQUIPMENT COMPANY, INC.
220 Hudson St., Seattle 8, Washington

Unused General Electric M-G Set

250 HP 3/60/4160V/1180 RPM/type K/frame 6336Z 150 KW DC/250V/type CDM/frame. 1444/shunt 3 KW DC/250V/direct connected exciter. AC controller CR 7890-Y-1.

ALBERT HELLER CO.
210 SNEDIKER AVE., BKLYN 7, N. Y.

GENERATE YOUR OWN POWER WITH "UTILITIES APPROVED" EQUIPMENT

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

6250 KVA G.E. condens., 5 stage, 2300/4000 volts, 200# pressure, 800° TT, 3600 RPM.

3125 KVA G.E. condens. 130 P.S.I. 550 volts.

3125 KVA G.E. condensing 175/200 P.S.I., 2300 volt, 500° TT, 3600 RPM complete.

1563 KVA G.E. non-condensing 250 P.S.I. 25# gauge back, 2400 volts, 3600 RPM.

1563 KVA G.E. condensing 250 P.S.I. 2300 volts, 3600 RPM complete.

937 KVA Allis non-condensing 125 P.S.I. 10# gauge back 480 volts.

925 KVA G.E. non-condensing 150 P.S.I. 15# gauge back, 480 volts, 3600 RPM.

625 KVA Allis-DeLaval non-cond. 80 to 125 P.S.I. 10 to 15# gauge 2300/480 volts.

625 KVA Westinghouse condensing 150/200# pressure, 2300 volt, 3600 RPM complete.

625 KVA G.E. non-condensing 150# pressure 15# back, 2300 volts, 3600 RPM complete.

375 KVA (4) G.E. condensing 400# pressure, 480/600/2300/4150 volts complete.

112 KVA G.E. non-condensing 125# pressure 10# gauge back 480 volts.

100 KVA Westg. non-condensing 125 to 150# pressure, 10# gauge back, 2400 volts.

Direct Current

400 KW (2) 240 volts direct current Crocker-Wheeler Worthington 440 lbs. condens.

150 KW (2) 3 wire, 250 volts, 225/250 P.S.I. Westinghouse-Worthington condensing.

100 KW G.E. 125 volt 200-275 P.S.I.

75 KW Allis-Chalmers-Terry, 125 volts, 2400 RPM, 150# pressure non-condensing.

75 KW (2) Westinghouse - Moore 120 volt, 200# pressure, condensing.

60 KW (3) new Westinghouse 120 volt, 280# pressure, condensing.

SYNCHRONOUS MOTORS

3 Phase, 60 cycle

3000 KVA Westghs. 4000 volt. 720 RPM (condenser)

900 HP Allis, 2200 volts, 150 RPM

75 HP G.E. 230 volts, 720 RPM

300 HP 80% P.F. G.E. 2300 volts, 720 RPM

MOTOR GENERATOR SETS

500 KW General Electric 600 volt DC, direct connected to 710 HP, 3 phase 60 cycle, 2300 volt, 720 RPM synchronous motor.

400 KW General Electric 275 volt DC, direct connected to 710 HP, 3 phase 60 cycle 2300 volts, 720 RPM synchronous motor.

300 KW Allis, 250 volts DC generator direct connected 430 HP Allis 3 phase 60 cycle, 440 volt, 1200 RPM synchronous motor.

150 KW G.E. 125 volt direct current generator direct connected 225 HP, 3 phase 60 cycle 220 volt, 1200 RPM synchronous motor.

82½ KVA G.E., 60 cycle, 2300 volt, alternator to 75 HP, 125 volt DC motor.

ENGINE-GENERATOR UNITS

Direct Current

400 KW G.E. 240 volts, 360 RPM generator connected Skinner Unaflow vertical engine 150#, 10# gauge back.

275 KW Westinghouse 250 volt, generator connected Ames vertical Unaflow engine.

250 KW (2) G.E. 3 wire 250 volts generators connected Skinner Unaflow Engines.

100 KW Burke 3-wire, 250 volt generator connected Skinner Unaflow engine.

ENGINE-GENERATOR UNITS

Alternating Current—3 phase, 60 cycle

750 KVA G.E. 2300 volts generator connected Skinner Vertical Unaflow non-condensing engine 150# P.S.I.

625 KVA Westinghouse 240 volts, generator connected Skinner Unaflow Engine.

375 KVA G.E. 2300/440 volts, generator connected 23"x24" Skinner Horizontal Unaflow Engine 120—150 P.S.I.

175 KVA Westg. 240 volt generator connected Skinner Horizontal Unaflow Engine.

JUNE BARGAINS

1—8400 sq. ft. and 1—4400 sq. ft Worthington surface condensers.

4—900 KW, 250/375 volt, direct current generators connected 1200 HP, 8 cylinders 720 RPM Fairbanks Diesel Engines.

1—5425 GPM, 70 foot head Centrifugal pump connected 125 HP 60 cycle, 2200 volt, 1750 RPM G.E. motor.

2—1000 GPM, 1270 foot head, 4-stage Morris pumps each direct connected to a 417 HP, 3900# P.S.I. non-condensing G.E. turbine.

UMC UTILITIES MACHINERY CORP.

1965 EAST 6th STREET • CLEVELAND 14, OHIO • Long Distance 422

DIESEL ENGINE GENERATING UNITS

KVA	VOLTS	ENGINE HP	CYL.	B & S	MODEL
47½	220	F & M 60	4	14x17	32
90	2300/220	F & M 120	2	14x17	32
100	220	Fulton 135	4	8x11½	L
200	2300/440	F & M 240	4	14x17	32
200	2300/440	F & M 240	4	14x17	V-VA
300	2300/440	F & M 360	6	14x17	32
300	2300/440	F & M 360	6	14x17	V-VA

DIESEL ENGINES

HP	MFG.	CYL.	B & S	MODEL	RPM
80	F & M	4	8 x 6½	348 (Marine)	360
82	Cat.	6	4½x 5½	D-4600	1200
115	Cat.	6	5¾x 8	D-13800	900
120	Atlas	6	5½x 8	D-17000	900
135	Cat.	8	7 x 8½		600
140	Atlas	6	7 x 8½		600
150	F & M	5	8½x10½	HD-4400	450
160	F & M	6	8½x10½	35-HE	450
180	Buda	6	6¼x 7½	JL-1355 (Gas)	1200
200	Buda	6	6¼x 8¾	D-1742	900
240	F & M	6	10 x12½	HC-44-10	425
360	F & M	6	14 x17	Y-VA	257

GENERAL MACHINERY & EQUIPMENT CO., INC.
Te. Vi-0918 Kansas City, Mo. 880 Woodland

MODERN DIESEL GENERATING PLANT

300 HP used Fairbanks - Morse Diesel engine, model 32-E-14, serial No. 795310, direct connected to 200 KW Fairbanks-Morse generator, .8 PF., 3 phase, 60 cycle, 240 volt, (can be reconnected to 440 volt). Complete with switch gear, starting equipment, pumps, enclosed cooling system, circuit breaker, silencer and stack.

PRICED TO SELL
DENNY & CLARK
1923 W. North Ave., Chicago 22, Ill.

200-175-150 HP Slip Ring Motors
28x48 & 24x48 Corliss Engines
125 HP 150# 1947 Steam Generators
150 HP 150# Erie Economic Boiler
483 HP (2) 225# WT Boilers—1944
150 HP 900 RPM 220/440 V. Sq. Case
400 & 300 HP Spreader Type Stokers
600 HP Slip Rg. & Sq. Case—NEW
H. & P., 6719 ETZEL, ST. LOUIS 14, MO.

Quality SINCE 1906

Wente SINCE 1906 *Motors*

WIDE SELECTION UNUSUAL VALUES

THEIR ELECTRICAL CONSTRUCTION HAS BEEN REBUILT . . . BY EXPERTS

SQUIRREL CAGE
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

Qu.	HP	Make	Type	Speed
1	50	G.E.	I (2200 V.)	900
2	50	Al. Ch.		900
1	60	G.E.	KT	1800
4	60	G.E.	KT (2200 V.)	1200
1	60	Reliance	AA	900
1	75	G.E.	KT	1250
1	100	G.E.	KT (2200 V.)	900
4	100	G.E.	K (TEFCBB)	1200
1	110	G.E.	KTP	1800
1	120	G.E.	PT	3600
2	125	Cr. Wh.	120Q	450
8	125	Al. Wh.	AB	450
2	150	Al. Ch.		1750
1	250	G.E.	I-17	900
1	250	G.E.	KF (Vert.)	3600

SLIP RING—SYNCHRONOUS
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

Qu.	HP	Make	Type	Speed
1	50	Al. Ch.		720
1	50	Ideal	AV	600
1	50	G.E.	I	700
1	60	Ideal	AVX	1200
1	75	West.	CW	450
1	75	G.E.	I	850
1	75	Fr. Morse	BV (2200 V.)	1800
1	100	G.E.	TBB (1.0 PF)	600
1	100	G.E.	I-16 (2200 V.)	450
1	100	West.	CW (R.P.)	1000
1	100	KW G.E.	ATB (.8 PF)	900
1	125	Fr. Morse	T (2400 V) (PF1.0)	900
1	150	West.	CW	450
1	200	West.	CW (3 Bear.)	600

D.C.—230 VOLT
(Other voltage as noted)

Qu.	HP	Make	Type	Speed
1	50	West.	SK	850
1	50	G.E.	CD 1341	500/2000
3	50	Reliance	T	2700
1	50	West.	SK (115 V.)	500
1	60	West.	SK (115 V.)	500/1500
1	75	Diehl	K11	700
2	75/100	Reliance	T1050	300/900
1	100	West.	SK	850
1	100	Cr. Wh.	CM	900
1	100	Cr. Wh.	CMC (550 V.)	1200
1	150	West.	SK	400/1200
1	150	West.	SK	850
1	180	Cr. Wh.	CMC	450
2	200	Reliance	T1250	300/900
2	200	G.E.	TLC-74	1250/4000

M-G SETS

1— 45 KW West. 60 V DC—440 V AC 1200 RPM
4— 60 KW G.E. 60 V DC—440 V AC 1200 RPM
2— 75 KW El. Prod. 230 V DC—440 V AC 1200
1—100 KW West. 250 V DC—440 V AC 1200
1—100 KW West. 250 V DC—440 V AC 900
1—100 KW Reliance 250 V DC—230 V AC 1200
1—100 KW Ridge 275 V DC—440 V AC 1200
1—150 KW G.E. 275 V DC—440 V AC 900
ALSO—4000 motors other than listed from 1 HP to 200 HP

Wente SINCE 1906 *The Wente Electric Co., Hamilton* 203 NO. FOURTH ST. Phone 4-8128 *Ohio*

Most all units still on foundation. Many may be seen operating

TURBO. GENERATOR UNITS

1500 KW. GE Non-Condensing 3/60/2300 V.
1000 KW. (2) Elliott Condensing-Bleeder 3/60/480 V.
ALSO TURBO UNITS; NON-CONDENSING & CONDENSING; from 50 KW. to 2500 KW.

BOILERS

LBS OF STEAM PER HOUR
45000 B&W SEC. HDR., 200#
40000 B&W FF 15; Integral furnace 200#
25000 B&W F16; Integral Furnace 200#
15000 (2) B&W 3 drum; low hd., 160#
15000 (2) B&W 3 drum; low hd., 200#
10000 Keeler; self contained, 250#

STEAM ENGINE SETS A.C.

500 KVA GE-Skinner Uniflow
312 KVA (2) GE-Skinner Uniflow
187 KVA Wghse.-Ames Uniflow, *Vertical*
62 KVA GE-Ames Uniflow

DIESEL UNITS A.C.

250 KVA (2) GE-Buckeye 8 Cyl.
106 KVA GE-Murphy 6 Cyl., *Portable*
90 KVA Fairbanks Model 32
75 KVA (2) General Motors; *Portable*

COMPRESSORS

850 CFM (2) 110 lbs., Chicago Pneumatic, *diesel driven*
ALSO ALL SIZES 150 CFM to 1000 CFM.

PUMPS (Motor & Turbine Driven)

From 200 to 2500 GPM; from 200 to 2500' hds.

BLOWERS (Turbine & Motor Driven)

ALL SIZES UP TO 10,000 CFM

HEATERS (Deaerating)

FROM 50M to 250M # per Hr.

ELECTRIC FURNACES

ALL SIZES; COMPLETE WITH SWITCHGEAR & TRANSFORMERS

COAL & ASH EQUIPMENT

COMPLETE EQUIPMENT FOR HANDLING 20,600 lbs. per hr.; Riley Pulverizer. Maximum 25 tons of Ash & Flyash per hr. (NEW)

STOKERS, PULVERIZERS — ALL SIZES AND TYPES.

CORLISS ENGINE — 18x36 Allis Chalmers (New)

TRANSFORMERS—MOTOR GENERATOR SETS

ADVISE YOUR REQUIREMENTS FOR PLANT EQUIPMENT

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt St.
New York, N. Y.

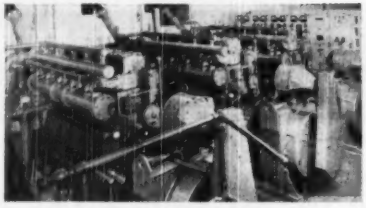
FOR SALE
WORTHINGTON-WESTINGHOUSE
INSTALLATION

COMMERCIALLY UNUSED

•

IMMEDIATE DELIVERY

•



3 Worthington Model BB 5—150 HP Diesel Engine Generating Units direct connected to Westinghouse Generators.

Rated 100 KW—125 KVA—3 phase, 60 cycle, 460 Volts, AC Current at 600 RPM.

Suitable for reconnection to 85 KW—3/50/230/400 at 500 RPM.

Complete with all accessories and auxiliaries including evaporative coolers—switchboard—distribution panel.

OWNED & OFFERED BY

KANE-McGUIRE COMPANY

Single units available

1492 East 32nd Street
Brooklyn, New York
PHONE: WHitehall 3-6843

FOR SALE — NEW MATERIAL

31,000 Lineal feet #2/0 Medium Hard Drawn Standard Bare Copper Wire

400,000 Lineal feet No. 1/0 Hard Drawn Concentric Lay 7-Strand Bare Copper Conductor

150,000 Lineal feet 3/8" 1 x 7 Guy Strand Galvanized Steel, High Strength in 5,000' Reels.

CALL — WIRE — OR WRITE

GLAZER STEEL CORPORATION
7930 PALM STREET
NEW ORLEANS, LOUISIANA
Telephone AUDUBON 2603

FOR SALE

1—Nordberg Uniflow Engine, 14 x 20, direct connected G. E. Generator, 125 KW, 240/-3/60, with switchboard and voltage regulator. *Excellent running condition.*

CHARLES V. FISH
501 Commonwealth Bldg., Allentown, Penn.

FOR SALE

1—Skinner Uniflow Engine, 150 to 8 pounds pressure, direct connected to Electric Machinery Alternator 480/3/60.

THE C. H. NORTON CO.
North Westchester, Conn.

USED TURBINES FOR SALE

1 Westinghouse Steam Turbine purchased in 1921. Located at our Muscatine, Iowa, Factory.

5 Elliott Steam Turbines, purchased in 1937; and

2 Dean Hill Turbines purchased in 1943. Located at our Fremont, Ohio, Factory.

Contact: L. N. KLOPPMAN

H. J. HEINZ COMPANY

P. O. Box 57, Pittsburgh 30, Pa.

FOR SALE

7 Panels—Modern G.E. Metal-clad 15 KV switch gear at approximately half price
1000 KW G.E. Turbo unit and condenser
Two 2000 GPM pumps with motors.
I-R Compressor 20,000 CF/HR at 100# pressure
Motor-driven Blower—1000 cfm at 4 lbs.
Room 4200, 310 South La Salle St., Chicago 4, Ill.

BOILER

Union Iron Works, 535 h.p. horizontal tubular Boiler, 3 drum, A.S.M.E. Code, 190# steam pressure, complete with the following: Superheater, boiler meter, soot blowers, electric eye, coal pulverizer, steel coal bin and bucket conveyor, new 1938, condition good. Sacrifice for quick sale.

Surplus & Salvage Co., Inc.
Jamestown, N. Y.

TWO STOKERS, COMPLETE

Detroit Overfeed Rotostoker—double feed. Capacity: 500 boiler H.P. Grate area: 45 sq. ft. Grate dimensions: 6 ft. x 7 ft. 6 in. Stokers complete with forced draft fans. Stoker parts: 4 feed units, 2 drive units, 2 blower fans, 2 wind tunnels, 2 set grates, 2 boiler fronts for mounting feed units.

PURITY BAKERIES

97 E. 12th St. St. Paul 1, Minn.

IF THERE IS

Anything you want

that other readers of this paper can supply

OR—

Something you don't want

that other readers can use, advertise it in the

SEARCHLIGHT SECTION

FOR SALE

1—360 K.W. A.C. General Electric Generator #2540236, 60 Cy, 480 Volt, 3 Ph, 150 R.P.M. With Belt Driven Exciter.

Direct Connected to 23"x28" Chuse Four Valve Engine #1471, 150 R.P.M.

Complete Switchboard Panel and General Electric Diactor Regulator.

All in Very Good Shape.

1—33.6 K.W. A.C. General Electric Generator #308632, 60 Cy, 480 Volt, 3 Ph, 300 R.P.M. Belted Exciter.

Direct Connected to 10"x10" Ideal Piston Valve Engine #3469.

Complete Switchboard Panel and General Electric Diactor Regulator.

1—75 K.W. A.C. Electric Machinery Generator #77007, 60 Cy, 480 Volt, 3 Ph, 277 R.P.M. With Direct Connected Exciter.

Direct Connected to 14"x14" Enterprise Piston Valve Engine #1495.

Complete Switchboard Panel and General Electric Diactor Regulator.

In Very Good Shape

2—Cummines, 100 H.P., Six Cylinder, 1200 R.P.M. Diesel Engines.

Direct Connected to 50 K.W., 3 Ph, 60 Cy, 480 Volt, A.C. Generator. Belted Exciters.

1 of These Engines Has Less Than 100 Hours of Service; 1 Has Less Than 2000 Hours of Service. Both Complete Switchboard and Regulator.

1—Fairbanks Morse, 20 H.P., Two Cylinder, 1200 R.P.M., Diesel Engine.

Direct Connected to Fairbanks Morse 12 K.W., 3 Ph, 60 Cy., 480 Volt, 1200 R.P.M. Generator. Belted Exciter.

Complete Switchboard Panel and General Electric Diactor Regulator.

Good Shape

1—Electric Machinery Co. A.C. Generator, 286 amp., 3 Ph., 60 Cy., 440 Volt, 450 R.P.M. Stub Shaft and Direct Connected Exciter.

Good Shape

1—Motor Generator Set. Allis Chalmers' A.C. Motor, 40 H.P., 3 Ph., 60 Cy., 220 Volt, 900 R.P.M., 98 amp.

Direct Connected to 30 K.W., 220 Volt, 120 amp., D.C. Generator, 900 R.P.M. With Starter.

Good Shape

1—Engberg Vertical Piston Valve Engine.

Direct Connected to 25 K.W., A.C. Generator, 3 Ph., 60 Cy., 220 Volt. Belted Exciter.

Good Shape

THE WABASH SCREEN DOOR COMPANY
2222 Elm Street, S.E.
Minneapolis 14, Minn.

FROM AVAILABLE STOCK

Rebuilt to N.I.S.A. Standards

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	1800	G.E.	600	125/250	4000
1	1500	G.E.	600	600	2300/4150
1	1500	G.E.	360	275	2300/4160
1	1250	G.E.	600	275	2300
1	1000	G.E.	720	250	2300/13200
1	1000	Whse	900	600	2300/4150
1	1000	West.	514	250	4150
1	800	G.E. (2U)	1200	120/240	2300
1	750	Whse	900	250	2300
1	500	G.E.	900	250	440/2300
1	500	G.E.	720	125	2300/4000
1	400	G.E.	720	250	440/2300
1	400	G.E.	1200	120/240	440
1	400	G.E.	720	600	9500
1	250	G.E.	900	125	2300/4150
1	200	Whse.	1200	250	1200
1	150	Cr. Wh.	1200	250	440
1	140(2U)	Cr. Wh.	690	125/250	2300
1	100	G.E.	1170	125	220
1	75	Cr. Wh.	1170	250	220/440
1	75	Cr. Wh.	1200	250	550

ROTARY CONVERTERS

60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1—	2000	G.E.	514	600	13800
1—	2000	G.E.	450	600	2300
1—	1000	Whse	900	600	11000
1—	750	Whse.	900	600	13200

RECTIFIERS

1— 750	G.E.	BHW	575	2300
1—1000	A.C.	B-612	625	13500
1—1000*	A.B.B.	GBZ	625	6600/13200

*This unit with full automatic control good for both 25 and 60 cycle.

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	6000	G.E.	Auto Extraction 250# IBP 15# Ext. 2400V. 3 ph. 60 cy.
1	1000	G.E.	Condensing 135/150# IBP 2300/4150 V 3 ph. 60 cy.
2	750	G.E.	Condensing 250/375# IBP 440V 3 ph. 60 cy. (New 1944)
2	400	G.E.	Condensing 275# IBP Geared to 1200 RPM. 120/240V. D.C. Generator.
1	300	Worth.	Non-condensing 125/150# IBP 5/20# B.P. 240/480V 3 ph. 60 cy. direct conn. exciter.
1	300	G.E.	Non-condensing 150/175# IBP 5/15# B.P. 480V. 3 ph. 60 cy.
1	300	Al. Ch.	Condensing 425# ISP Geared to 1200 RPM 120/240V D. C.
	200	Cr. Wh	Condensing 250# ISP GEARED to 1200 RPM—125V. D.C. Gen.
1	200	Whse.	Non-condensing 150# ISP 7# B.P. 240V. 3 ph. 60 cy.

TRANSFORMERS

60 Cycles

Qu.	KVA.	Make	Type	Ph.	Voltages
1	2500	Packard	AT	3	13800 x 2300
1	2500	Al. Ch.	OISC	3	13200 x 2300
3	1000	Pitts.	OISC	1	13200 x 2300
3	1250	G.E.	H	1	6600 x 550
1	1650	G.E.	WOTH	3	11000 x 445
1	1000	Maloney	OISC	3	13200 x 480
1	500	Al. Ch.	OISC	3	4000/2300 x 216
3	333	Pitts.	OISC	1	26400 x 2000
3	250	Al. Ch.	OISC	1	2200 x 130
3	200	Whse.	OISC	1	7200 x 240/480
3	167	G.E.	OISC	1	2400 x 240/480

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—1750	Whse.		600	535/720
1—1500	Whse.		550	600
1—1200	Whse.		600	425
1—940	Whse.	QM-R.Brg.	250	140/170
1—800/1000	Whse.		450	600/720
1—650	G.E.	MPC	250	115/145
1—600	Al. Ch.	MILL	250	400/800
1—500/400	G.E.	DYNA	250	1325/2560
1—335	Whse.	MQ	250	300/900
1—300/200	G.E.	MPC	230	360/920
1—275	Whse.	QM-600-4	250	425/850
1—250	G.E.	MPC	230	400/560
1—150	G.E.	MPC	230	250/450
1—150	G.E.		600	250/750
10—150	Cr. Wh.	83H	250	800

FREQUENCY CHANGERS

1—2000	G.E.	25/60 Cycle	2300/2300V
1—500	A.C.	25/60 cycle	11000/2300V

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—2500	G.E.	TS	2300	257
1—2100	G.E.	ATI	4000	514
2—2000	Whse.		2300	150
1—1470	Whse.		4000	900
1—1000	Whse.		2300	1894
2— 900	Al. Ch.	(New)	2200	150
1— 650	Whse.	G	2200	138
1— 600	Whse.	Syn.	440	360
1— 450	Whse.	Eng.	2200	128.5
2— 350	G.E.	TS	2300	150
1— 350	G.E.	ATI	2300	600
1— 300	G.E.	ATI	440	720
1— 300	Whse.		2300	720
1— 300	Al. Ch.		440	600
1— 225	G.E.	ATI 1-Brg.	440	900
1— 125	G.E.	ATI	440	450
1— 100	E.M.	Unused	440	600
1— 100	Whse.		550	600

SLIP RING

1—1000	Whse.	CW	2300	700
2— 700	Whse.	CW	2300	900
1— 500	G.E.	IP	550	885
1— 500	G.E.	IM-MIII	2300	450
1— 500	G.E.	MT 412	440/2300	705
3— 350	Whse.	CW	2200	900
1— 350	G.E.	MT-443Y	2300/4000	253
1— 300	Al. Ch.	3 Brg.	2300	805
1— 300	G.E.	IM	440	720
9— 300	Al. Ch.	ANY	2200	708
1— 250	G.E.	MT-424Y	4000	257
1— 250	G.E.	MT-550R	2200	1750
4— 100	G.E.	MT-364Y	440/220	425
2— 100	G.E.	IM-10	2300	435
2— 100	G.E.	IM	440	600
3— 100	Al. Ch.	AK	2200	1200

SQUIRREL CAGE

2— 450	Whse.	CS	2300/4150	354
1— 200	G.E.	IK	550	865
1— 200	G.E.	KT-557	440	1800
1— 200/115	G.E.	KF-559B8	440	1170/885
1— 125	Whse.	MS	440	485
1— 125	(New) G.E.	KF-TEFC	440	1190
1— 125	G.E.	KF-TEFC	440	3585
1— 125	Al. Ch.	ARW	2200	1750
1— 100	Al. Ch.	AB	2200	1170
1— 100	G.E.	IK-Vert.	2300	450
2— 100	G.E.	KT-543	220/440	1750

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	5140	Whse.		4150	600
1	4000	G.E.	T8C	2400/4800	900
1	3000	Whse.		4800	720

RE NU BILT BELYEA MOTORS

BELYEA COMPANY, INC.

43 Howell St., Jersey City 6, N. J.
Phone: Journal Square 2-3334
N. Y. Line: REctor 2-7150

TRANSFORMERS

FOR SALE

2— 150 KVA. 60 CY. 1 PH. 2400-240/480 SCOTT TAPS.
6— 100 KVA. 60 CY. 1 PH. 2400-240/120.
6— 75 KVA. 60 CY. 1 PH. 2400-240/120.
9— 50 KVA. 60 CY. 1 PH. 2400-240/120.
7—37½ KVA. 60 CY. 1 PH. 2400-240/120.
8— 15 KVA. 60 CY. 1 PH. 2400-480/240.

ALSO ALL TYPES OF AIR COOLED AND PHASE CHANGERS.

ATLANTIC TRANSFORMER CO.

5143 N. 2nd St. Philadelphia 20, Pa.

ADVERTISERS' INDEX

This index is a service to readers. Every effort is made to maintain its accuracy, but POWER cannot assume responsibility for errors or omissions. When a star appears after the name, the advertisement does not appear in this issue but appeared in an issue within the previous three months.

Aerotec Corp. ..... *
Air Preheater Corp. ..... *
Air Express Div.
Railway Express Agency 158
Allen-Sherman-Hoff Co. ..... Second Cover
Allis-Chalmers Mfg. Co. 16-17, 48, 157
American Blower Co. 66
American Brass Co. 135
American Chain & Cable Co. 65
American Chimney Corp. ..... *
American District Steam Co. 168
American Engineering Co. ..... *
American-Marsh Pumps, Inc. 264
American Pulverizer Co. 223
Anchor Packing Co. 41
Arkansas Fuel Oil Co. 169
Armstrong Cork Co. 167
Armstrong Machine Works 139
Atlas Valve Co. 206
Aurora Pump Co. 202

Babbitt Satem Specialty Co. 222
Babcock & Wilcox Co. 4-5
Babcock & Wilcox, Co., Refractories Div. 61
Babcock & Wilcox Tube Co. 231
Badger Mfg. Co. 260
Bailey Meter Co. 12-13
Baltimore & Ohio Railroad ..... *
Beaumont Birch Co. ..... *
Bell & Gossett Co. 226
Belmont Packing & Rubber Co. 194
Bernitz Furnace Appliance Co. 176
Betz Co., W. H. & L. D. 131
Biddle & Co., James G. 225
Bigelow Company ..... *
Birch Mfg. Co. ..... *
Bird-Archer Co. 252
Black, Sivalls & Bryson, Inc. 170-171
Blaw-Knox Co. ..... *
Boiler Tube of America ..... *
Bowser, Inc. ..... *
Bridgeport Brass Co. 221
Brown Boveri Corp. ..... *
Buell Engineering Co. ..... *
Buffalo Forge Co. 227
Buffalo Pumps, Inc. 64
Burgess-Manning Co. ..... *
Bussmann Mfg. Co. ..... *
Byers Co., A. M. 72

Canton Stoker Corp. 14-15
Carborundum Co. 56-57
Cardox Corp. 200
Carey Mfg. Co., Philip ..... *
Cash Co., A. W. 60
Catawissa Valve & Fittings Co. ..... *
Chapman Valve & Mfg. Co. 149
Chase Brass & Copper Co., Inc. 233
Chelsea Fan & Blower Co., Inc. 262
Chicago Metal Hose Corp. 265
Chicago Pneumatic Tool Co. ..... *
Cities Service Oil Co. 169
Clarage Fan Co. 46
Clark Mfg. Co. 180
Cleaver-Brooks Co. 165
Clipper Mfg. Co. ..... *
Cochrane Corp. 201
Coffin, Jr. Co., J. S. ..... *
Combustion Engrg.-Superheater, Inc. 30-31
Condenser Service & Engrg. Co. 236
Coppus Engineering Co. 55
Crane Company 54, 147
Cyclotherm Corp. 264

Darling Valve & Mfg. Co. 257
Dart Mfg. Co., E. M. 156
Davis Regulator Co. ..... *
Dearborn Chemical Co. 59
DeLaval Separator Co. 52
DeLaval Steam Turbine Co. 68
Detroit Stoker Co. ..... *
Diamond Power Specialty Corp. 8-9
Dowell, Inc. 153
Dravo Corp. 197, 230
Drew Co., Inc., E. F. 187

Eagle-Picher Co. ..... *
Eastern Gas & Fuel Associates ..... *
Economy Pumps, Inc. 215
Edward Valves, Inc. 125
Electric Machinery Mfg. Co. 179
Electric Storage Battery Co. 191
Elgin Softener Corp. ..... *
Elliott Co. 6-7
Engineer Co. ..... *
Erie City Iron Works 209
Ernst Water Column & Gage Co. 268

Fairfield Engineering Co. 290
Fairmont Coal Bureau 178
Fisher Governor Co. ..... *
Flexitallic Gasket Co. ..... *
Flexo Supply Co., Inc. ..... *
Foster Engineering Co. ..... *
Foster Wheeler Corp. 35-36
Foxboro Co. 164
Frick Co. 230
Fuller Co. 251

Garlock Packing Co. 253
General Electric Co.,
(Apparatus Dept.) 20-21, 42-43, 53
Globe Steel Tubes Co. 44
Golden-Anderson Valve Spec. Co. ..... *
Goodyear Tire & Rubber Co. 63
Gorman-Rupp Co. 262
Goulds Pumps, Inc. 186
Graver Water Conditioning Co. ..... *
Grinnell Co. ..... Third Cover
Griscom-Russell Co. 246
Gulf Oil Corp. 203
Gulf Refining Co. 203
Gunite Concrete & Construction Co. 230

Hagan Corp. 217
Hall Laboratories 67
Harbison-Walker Refractories Co. 173
Hays Corp. 211
Heacon, Inc. 244
Hendrick Mfg. Co. ..... *
Henszey Co. ..... *
Hewitt-Robins, Inc. 190
Hill Pump Valve Co. ..... *
Hoffman Specialty Co. 184
Homestead Valve & Mfg. Co. ..... *
Honan-Crane Corp. ..... *
Illinois Water Treatment Co. 238
Industrial Sound Control Co. 222
Infilco, Inc. ..... *
Ingersoll-Rand Co. 49, 260
International Nickel Co. 242
Iron Fireman Mfg. Co. 256

Jeffrey Mfg. Co. 163
Jenkins Bros. 143
Jerguson Gage & Valve Co. 212
Johns-Manville 137, 212
Jones Foundry & Machine Co., W. A. ..... *
Joy Mfg. Co. ..... *

Keasbey & Mattison Co. 162
Kellogg Co., M. E. 181
Kennedy Valve Mfg. Co. 166
Kennedy-Van Saun Mfg. & Engrg. Corp. 10-11
Kewanee Boiler Corp. ..... *
Kieley & Mueller, Inc. 183
Kinney Mfg. Co. ..... *
Koppers Co., Inc. (Coupling Dept.) ..... *
Kuljian Corp. ..... *

Leeds & Northrup Co. ..... *
Ladish Co. ..... *
Lapp Insulator Co., Inc. 216
Leslie Co. 240
Link-Belt Co. 3
Littleford Bros., Inc. (Gen. Div.) 198
Lockett & Co., A. M. ..... *
Lummus Co. 261
Lumnite Div.,
Universal Atlas Cement Co. 263
Lunkenheimer Co. 24-25

Manheim Mfg. & Belting Co. 239
Manning, Maxwell & Moore, Inc. 245
Manzel, Inc. ..... *
Marley Co. 265
Marsh Instrument Co. 237
Mason-Neilan Regulator Co. ..... *
McGraw-Hill Book Co. 266
Mercoid Co. 228
Midwest Piping & Supply Co. 58
Milton Roy Co. ..... *
Minneapolis-Honeywell Regulator Co.,
(Industrial Div.) 32-33, 62
Mitchell & Co., W. K. 177
Modine Mfg. Co. ..... *
Monsanto Chemical Co. 222
Murray Iron Works 192

Nagle Pump Co. 222
National Airoil Burner Co., Inc. ..... *
National Aluminate Corp. 141
National Electric Coil Co. 219
National Tube Co. ..... *
National Valve & Mfg. Co. 250
Niagara Blower Co. ..... *
Nicholson & Co., W. H. 224
Nordberg Mfg. Co. ..... *
Northern Equipment Co. 145
Norton Co. 26-27

Oakite Products, Inc. 224
Ohio Injector Co. 45
Owens-Illinois Glass Co. (Kaylo Div.) ..... *

Pacific Pumps, Inc. ..... *
Paraffine Companies, Inc. ..... *
Peabody Engineering Co. 214
Peerless Dump Div., Food Machy. & Chemical Corp. 232
Pennsylvania Crusher Co. 189
Penn Flexible Metallic Tubing Co. 247
Permutit Company ..... Back Cover
Petro-Chem Development Co., Inc. ..... *
Philadelphia Gear Works 235
Pioneer Service & Engrg. Co. 202
Pipe Fabrication Institute 175
Pittsburgh Piping & Equipment Co. 254
Pittsburgh Steel Co. ..... *
Plibrico Jointless Firebrick Co. ..... *
Powell Co., Wm. 50-51
Power Co., Inc., Edward M. 208
Powers Regulator Co. ..... *
Prat-Daniel Corp. ..... *
Preferred Utilities Mfg. Co. ..... *
Pritchard & Co., J. F. 188

Raybestos-Manhattan, Inc. Packing Div. ..... *
Reading, Pratt & Cady Div. 65
Reliance Gauge Column Co. 185
Republic Flow Meters Co. 38-39
Republic Rubber Div., Lee Rubber & Tire Co. ..... *
Republic Steel Corp. ..... *
Revere Copper & Brass, Inc. 142
Richardson Scale Co. ..... *
Ric-Wil Co. 37
Riley Stoker Corp. 106-107
Rohm & Haas Co. (Resinous Prod. Div.) 207
Ross Heater & Mfg. Co. ..... *
Roto Div. of Elliott Co. ..... *

Sante Fe Tank & Tower Co. ..... *
Sarco Co. 193
Sauerman Bros., Inc. 228
Schutte & Koerting Co. ..... *
Shaw Co., B. F. 133
Sier-Bath Gear & Pump Co. 228
Simplex Valve & Meter Co. 204
Sinclair Refining Co. 18-19
Skinner Engine Co. 160
Smith Corp., Winfield H. ..... *
Smith Refractories, Sanford S. 268
Socony-Vacuum Oil Co. 159
Sparkler Mfg. Co. 182
Spence Engineering Co., Inc. 267
Springfield Boiler Co. 47
Standard Oil Co. of Indiana 108A-108B
Standard Stoker Co., Inc. 210
Steel & Tubes Div. ..... *
Stephens-Adamson Mfg. Co. 34
Sticht Co., Inc., Herman H. 268
Stickle Steam Specialty Co. 262
Stock Equipment Co. 172, 208
Stone & Webster Engrg. Corp. 161
Strong, Carlisle & Hammond Co. 174
Struthers Wells Corp. ..... *
Sturtevant Div., Westinghouse Electric Corp. ..... *
Sun Oil Co. 129
Superior Combustion Industries 195
Swartwout Co. 151
Sweet's Catalog Service ..... *

Taylor Forge & Pipe Works 199
Taylor Instrument Co.'s ..... *
Terry Steam Turbine Co. 241
Texas Co. 155
Thermix Corp. 244
Tidewater Associated Oil Co. 40
Timken Roller Bearing Co. ..... *
Todd Shipyards Corp., Combustion Equipment Div. 206
Toledo Pipe Thread. Mach. Co. ..... *
Topflight Tape Co. ..... *

Tri-Lok Co. 230
Troy Engine & Machine Co. ..... *
Trumbull Electric Mfg. Co. 234
Tube Turns, Inc. ..... *

Union Iron Works ..... *
U. S. Steel Corp. ..... *

Viking Pump Co. 198
Vogt Machine Co., Henry 213
Vulcan Soot Blower Corp. 28-29

Wallace & Tiernan Products, Inc. 255
Walworth Co. 229
Warren Steam Pump Co. ..... *
Watson-Stillman Co. 196
Western Chemical Co. ..... *
Westinghouse Electric Corp. 70-71
Western Electrical Instrument Co. ..... *
Wheeler Mfg. Co., C. H. 243
Where to Buy 268
Wickes Boiler Co. ..... *
Wiedeke Co., Gustav ..... *
Wiley & Sons, John 220
Wilmot Engineering Co. ..... *
Wing Mfg. Co., L. J. 218
Worthington Pump & Machy. Corp. 259
Wright Chemical Corp. 266

Yarnall-Waring Co. 22-23, 127
Youngstown Sheet & Tube Co. 248

Zallea Bros. 249

Professional Services 268

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT
Positions Vacant 270
Selling Opportunities Offered 270
Positions Wanted 270, 271
Selling Opportunities Wanted 271
Employment Services 270

EDUCATIONAL
Books 271

BUSINESS OPPORTUNITIES
Offered 271

NOTICES
Proposal 271

EQUIPMENT
(Used or Surplus New)
For Sale 271-287

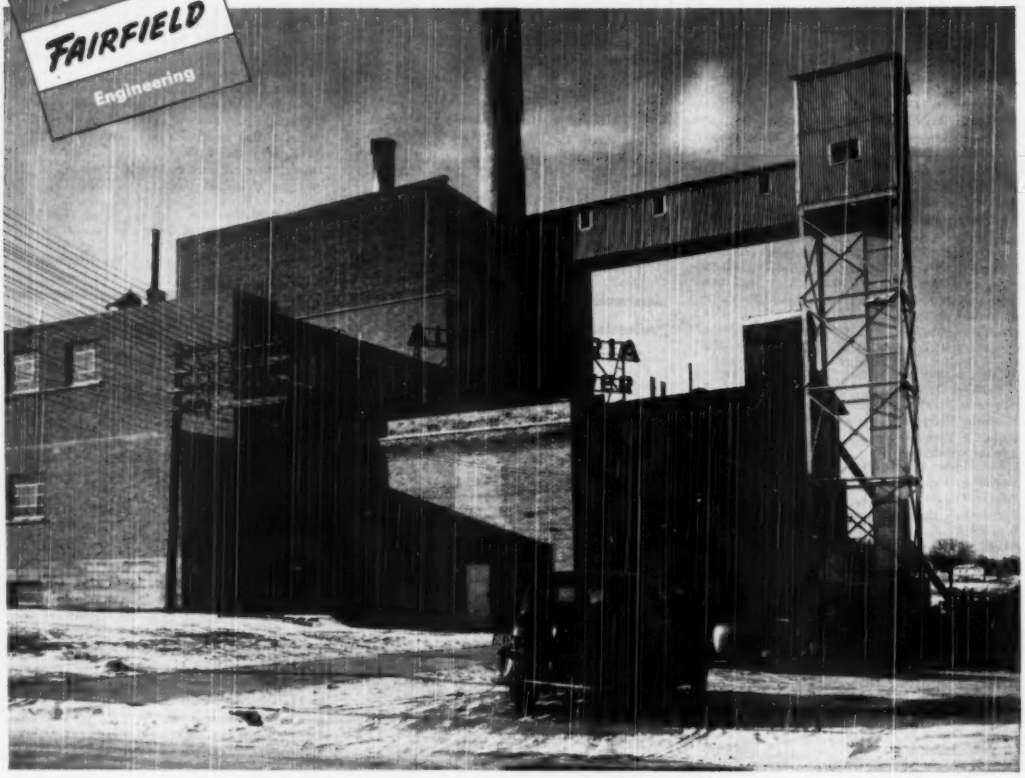
WANTED
Equipment 271

ADVERTISERS INDEX

Acker Co., George M. 281
Aljohn Diesel Co., Inc. 272, 284
American Air Compressor Corp. 276
Arrow Transformer Co., Inc. 283
Atlantic Transformer Co. 287
Automatic Combustion Equip. Co., Inc. 279
Bauer, L. W. 271
Belton Light & Power Co. 271
Belyea Co., Inc. 287
Boswick Electric Co., The 276
Brearley, H. P. 272
Brew, Woltman & Co., Inc. 280
Chicago Electric Co. 282
Darien 274
Denny & Clark 285
Diesel 284
Douglass Co., Stephen A. 284
Duquesne Electric & Mfg. Co. 283
Ebasco Services, Inc. 271
Electric Apparatus Repair Co. 272
Electric Equipment Co. 274
Electric Generator & Motor Co. 272
Electric Service Co., Inc. 284
Electronicraft, Inc. 274
Ellis Co., A. Lee 284
Empire Electric Co., Inc. 283
Erie Electric Co., Inc. 280
Fish, Charles V. 286
General Machy. & Equipment Co., Inc. 285
Glaser Steel Corp. 286
Glow Electric Co. 278
Greenebaum Tanning Co., J. 282
Gustafson, A. C. 284
H & P Machinery Co. 285
Hall & Co., Stephen 284
Heat & Power Co., Inc. 283
Heinz Co., H. J. 286
Heller Co., Albert 284
Hemphill & Co., J. L. 278
Hercules Elect. Machy. & Equip. Co. 281
Hobson & Sons, Russell B. 282
Industrial Electric & Supply Co., Inc. 271
International Power Machinery Co. 273
Johnson & Associates, Howard B. 281
Kane-McGuire Co. 286
Kirk Co., Wallace E. 273
Land, Inc., L. J. 274
Lefax 271
Lewon Bros. 271
Louisville Cooperage Co. 271
Mandel, H. P. 284
Martin, Wm. 284
MacCabe Co., T. B. 278
Meadow Gold Products Co. 271
Merrill & Co. 272
Mississippi Valley Equipment Co. 272
National Boiler & Equip. Co. 279
Newman & Co., Inc. 279
Northern Metal Co. 276
Norton Co., The C. H. 286
O'Neill, A. J. 282
Penn. Machinery Co. 282
Pierce Cable Co. 271
Power Plant Equipment Co., Inc. 286
Powerite Corp. 272
Prudential Plumbing Products Corp. 271
Purity Bakeries 281, 286
Rearick, Chas. B. 282
Salt River Power District 271
Schoonmaker Co., Inc., A. G. 281
Standard Oil Development Co. 271
Stanhope, L. M. 281
Sundflet Equipment Co., Inc. 274, 284
Surplus & Salvage Co., Inc. 286
Thompson Co., Inc., J. Parker 283
Tomsett Associates 270
Universal Wire & Cable Co. 276
Utilities Machinery Corp. 285
Wabash Screen Door Co., The 287
Wagner Co., Arthur 279
Weaver, Charles 277
Wente Electric Co., The 285
Winston, A. J. 274
Winston Machinery Co., Inc. 284

Progressive FAIRFIELD Engineering

SERVING THE NATION'S POWER PLANTS



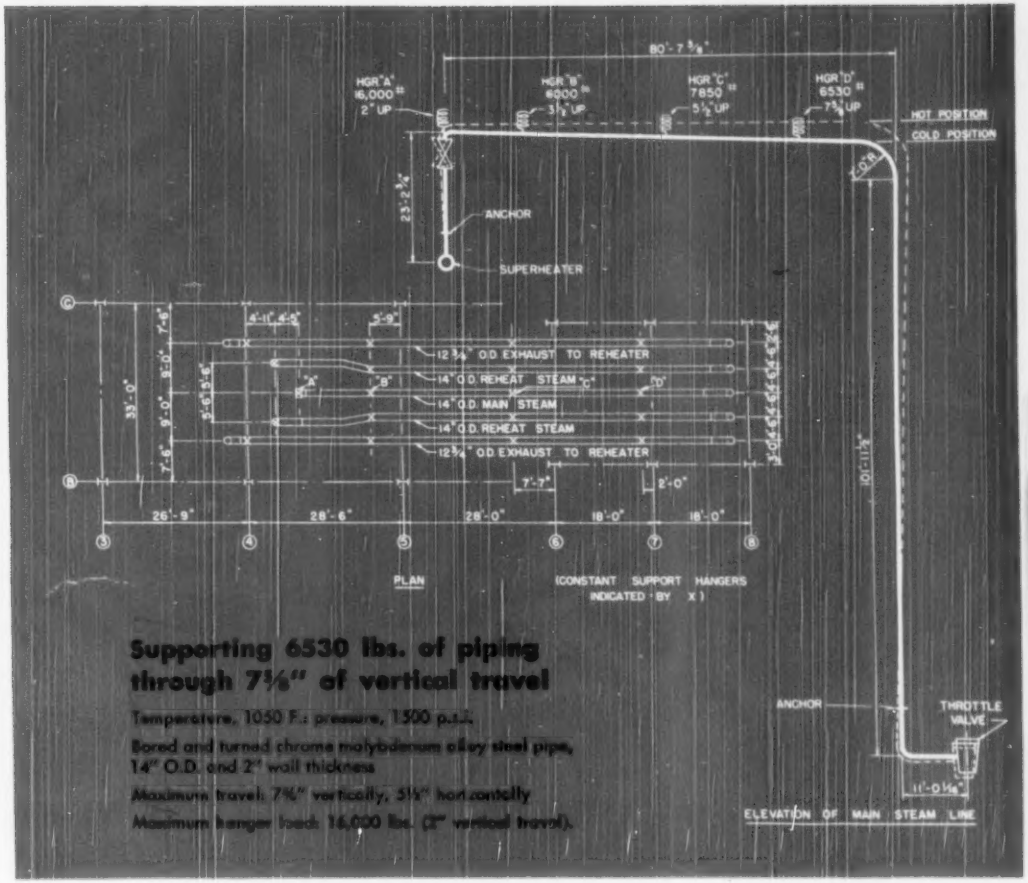
bringing the mountain to Mohammed

Today's story of the mining of raw materials, transporting them over countless miles, conveying and preparing these raw materials for conversion to energy at a constant and controlled rate, far exceeds the imaginary feat of "bringing the mountain to Mohammed".

Actually, for Fairfield Engineering, the feat of designing and building conveying systems, storage facilities, accurate boiler feeding devices to meet specific power plant needs has been a daily record of accomplishment for many years. For instance, the northwest municipal installation shown above . . . Fairfield engineers were called in to expand the existing Fairfield installation to serve an additional boiler. Specific requirements indicated a bucket elevator fed by an apron feeder from the track hopper. For loading the bunker, a tripper equipped belt conveyor loaded from the bucket elevator. Automatic scales, gates and chutes to pulverizers completed the installation.

This is but one example of the countless number of power plants across the country that has profited from Fairfield engineering and "know-how" over the past 35 years. If you contemplate overhauling, expanding, or improving your power plant operation, your experienced Fairfield engineer can serve you wisely. Write or call--

THE FAIRFIELD ENGINEERING COMPANY
335 Chicago Ave., MARION, OHIO



Supporting 6530 lbs. of piping through 7⅝" of vertical travel

Temperature, 1050 F.; pressure, 1500 p.s.i.

Bored and turned chrome molybdenum alloy steel pipe, 14" O.D. and 2" wall thickness

Maximum travel: 7⅝" vertically, 5½" horizontally

Maximum hanger load: 16,000 lbs. (2" vertical travel).

ONLY a Grinnell Constant-Support Hanger solves this problem easily, practically

Provides constant support to piping subject to vertical movement — in all hot and cold positions. Maintains full safety factor in supporting high temperature, high pressure piping. Non-resonant and energy absorbing. Mass-produced from standard precision parts. Individually calibrated for each installation. Load-adjustment features incorporated into design. Models to meet entire range of load-travel specifications. Minimum headroom required.

Believing that a good piping job is too important to be jeopardized by improvised or inadequate pipe hangers, Grinnell has developed a complete line of stock hangers and supports for every piping need from a simple water pipe to a high pressure, high temperature steam line. Write for Catalog 10-D.

100th ANNIVERSARY — WHENEVER PIPING IS INVOLVED

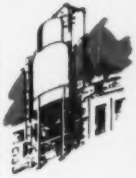
GRINNELL

Grinnell Company, Inc., Providence, R. I. Branches: Atlanta • Billings • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane

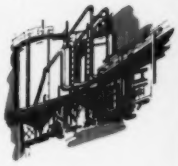
PERMUTIT PRODUCTS for POWER PLANTS

ZEO-KARB SOFTENER. The Permutit Zeo-Karb® Softener removes both hardness and bicarbonates from raw water. The effluent is soft and reduced in total solids and alkalinity. Sulphate-carbonate ratio may be adjusted as desired by a system of mixed effluents.

SILICA REMOVAL PLUS DEMINERALIZATION. Demineralization by cold ion exchange processes produces water of comparable quality to distilled water at a fraction of the cost of distillation. Treatment by an anion exchange resin, Permutit S®, reduces silica to less than 0.2 ppm.



DEAERATING HEATER. The Permutit Deaerating Heater, utilizing exhaust or bled steam, prevents corrosion of feed lines, stage heaters, economizers, and boilers by removing oxygen and free CO_2. Capacities from 12,000 to 1,400,000 pounds per hour are in service.



SLUDGE BLANKET HOT LIME SODA. The application of the sludge blanket design to hot lime soda treatment gives you soft water of a low silica content. **HOT ZEOLITE.** Subsequent treatment by Permutit Q® yields a final zero-hardness effluent.

PRECIPITATOR. The Permutit Precipitator is used to lower alkalinity, reduce hardness, and help to remove turbidity. It can also be used to reduce silica.

These basic processes—plus Permutit skill—can solve your water conditioning problem

Whatever your water treatment problem, Permutit offers all types of equipment and minerals that can supply soft, clear, chemically correct water for your plant. Write for full information to The Permutit Company, Dept. P-6, 330 West 42nd Street, New York 18, N. Y., or to Permutit Company of Canada, Ltd., Montreal.

Permutit®

FOR OVER 37 YEARS

WATER CONDITIONING HEADQUARTERS